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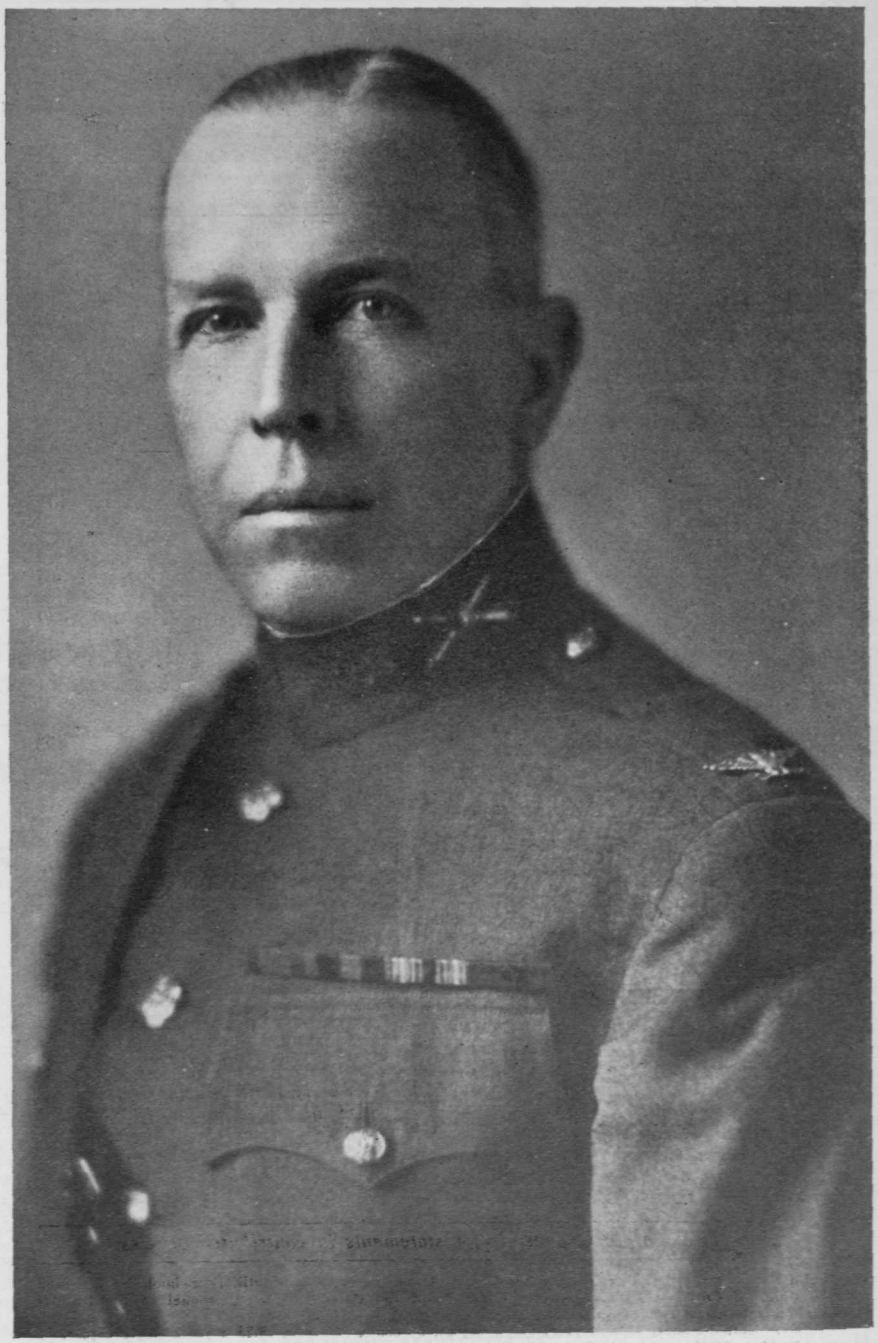


MAJOR GENERAL ANDREW HERO, JR.
Chief of Coast Artillery

THE COAST ARTILLERY JOURNAL

Volume 64 APRIL, 1926 Number 4

A Graphical Solution of the Trial Shot Problem for Antiaircraft Artillery

CAPTAIN BENJAMIN F. HARMON
Coast Artillery Corps

SECOND PRIZE, JOURNAL ESSAY COMPETITION, 1925

THE antiaircraft artilleryman is confronted with difficulties in spotting which have so far proven insurmountable and which give every indication of remaining so. Just as true spotting in engaging marine targets should be based on the setforward point, so should it be in firing at aerial targets — but what an immeasurable difference exists between the difficulties entailed in the two solutions! Unless the antiaircraft gunner can say with certainty that his target has adhered to the course on which the prediction was made the deviations observed would be deceptive, and corrections based thereon would be damaging to the success of his fire. And he is never certain of adherence to the conditions of rectilinear flight on which the position finding system is based. Then, too, the brief time during which the target will be within range precludes any deliberation in the fire for spotting purposes. Each battery will fire a round every second, and the target will be, normally, under the combined fire of two or three batteries; so it may be imagined that the identification of single bursts for spotting borders on the impossible. Finally, and perhaps most important of all, it must be realized that deviations without concurrent range spottings are meaningless and that range spottings are at present unattainable. The Battery Commander who observes his bursts five mils left and orders "five right" is improving the appearance of his fire, but he is not improving its value unless the range is correct.

The antiaircraft artilleryman is compelled to prepare his fire before action by means of trial shots. He has no more important technical duty than his preparation of fire. There are objections to the present method of computing the corrections from trial fire, which objections are intensified when the importance of this fire is recalled. The present

NOTE—The method of solving trial shots graphically was first suggested by Major B. W. Simpson, O. D., but the details of the solution herein are original with this paper.

method is lacking in the accuracy it should have and it entails considerable difficulty in instruction. It is hoped that the graphical method, when perfected, will enable the student to grasp the problem most easily by visualizing it and will effect a material increase in the accuracy of the solution of antiaircraft trial firing problems.

The discussion following is based on data derived from Firing Tables 3-AA-I 1 and the trajectory chart pertaining thereto, which apply to the Mark III Scovil fuze as fired from the Model 1918 gun. The ballistic data in these tables are presented in much greater detail than in the tables now in the hands of the service and consequently enable a more thorough study of any ballistic problem to be made. It is not practicable to reproduce the tables in this article but their scope will be indicated by the table of contents which follows:

Part 1—Trajectory Data. Horizontal range, altitude, and angular height as functions of time of flight and quadrant elevation.

Part 2—Fuse Setter Data. Horizontal range, altitude, angular height, superelevation, and time of flight as functions of fuse range and quadrant elevation.

Part 3—Drift Data. Drift as a function of quadrant elevation and time of flight.

Part 4—Probable Error Data. Four probable errors in time of flight, along the trajectory in yards, in the plane of the trajectory in yards with direction normal to the trajectory, and in deflection in yards are listed with time of flight and quadrant elevation as arguments.

Part 5*a*—Differential Effect for Quadrant Elevation. The effect on horizontal range, altitude, and angular height for a 10-mil increase in elevation is shown as a function of quadrant elevation and time of flight.

Part 5*b*—Differential Effect for Muzzle Velocity. Similar to Part 5*a*.

Part 5*c*—Differential Effect for Air Density. Similar to Part 5*a*.

Part 5*d*—Differential Effect for Rear Wind. Similar to Part 5*a*.

Part 5*e*—Differential Effect on Deflection for Cross Wind. This effect is listed both in yards and in mils as a function of quadrant elevation and time of flight.

Trial shot firing, as heretofore presented, consists in selecting a point in the heavens, firing five rounds at that point and correcting for the full deviation of the center of impact of the group as well as for any deviation of the time of flight from normal. That basic conception is unchanged. Two paramount considerations have always dictated the selection of the Trial Shot Point (TSP):

First.—Altitude is the most important element of the firing data and must be studied most carefully. Therefore, conditions should be selected wherein any variation in the rate of burning of the fuse will have no

appreciable effect on the altitude. This condition entails the selection of the TSP at the summit of a trajectory.

Second.—The altitude selected for the firing should be that at which the approaching targets are reported to be flying, or the altitude at which past experience has taught that they may be expected according to existing atmospheric conditions, or immediately under a cloud stratum, where such stratum forms a low ceiling.

In addition it must be emphasized that any target will be engaged at maximum range by an alert battery, and should be so engaged due to the probable brief exposure of the target to fire. This in itself will impel the opening fire to be at the summit of a trajectory except at extremes of altitude. Furthermore the mathematical solution of the trial shot problem now prescribed will be gravely in error under any other conditions of fire than at the summit of a trajectory. (The errors will be shown in detail later.)

The truism that the summit of a trajectory should be used for the TSP remains. It is well, however, to develop a general method and to qualify the ideal selection with "if possible," realizing that conditions of visibility may prohibit its use. From a study of the trajectory chart the quadrant elevation and fuse range for the selected TSP may be read and these two elements used as arguments to enter Part 2 of the firing tables and to determine the remaining data for the selected point. A point well on the ascending branch of the trajectory will be selected for demonstration.

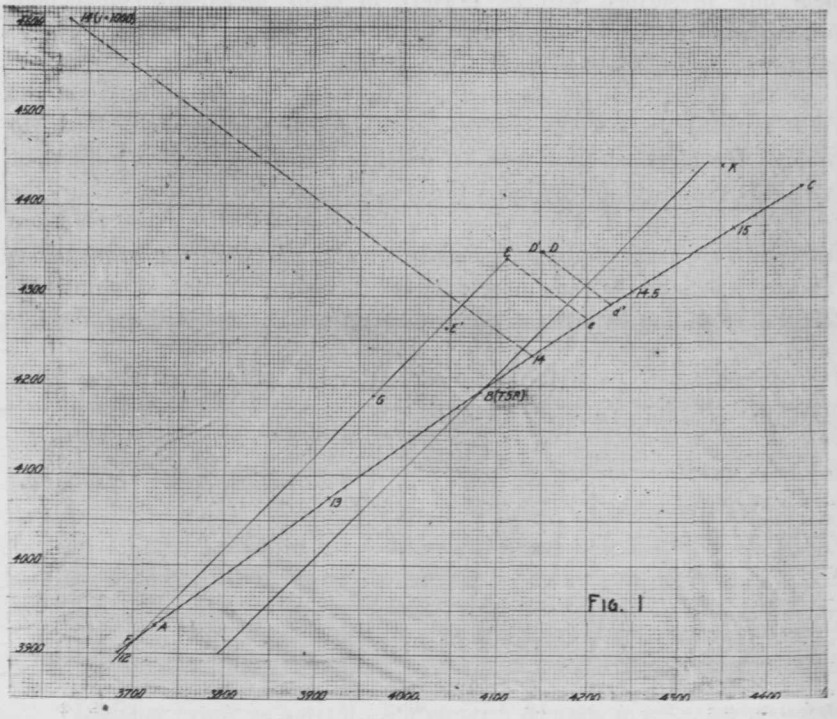
Following is a tabulation of the data determined prior to the firing and that resulting from the firing:

	Symbol	*Unit*	*Preliminary Data (TSP)*	*Observed Data*
Fuse Range	B		12	
Altitude	H	Yards	4139	4300
Angular height	S	Mils	808	818
Quadrant elevation	i	Mils	900	
Time of flight	t	Sec.	13.72	14.50
Vertical deviation	VD	Mils		+ 10
Lateral deviation	LD	Mils		*L 2
Wind speed	W	m. p. h.	20	
Wind direction		Mils	3200	
Direction of fire		Mils	1066	
Wind-fire angle	ϕ	Mils	1066	
Density		%	95	

No change in the conduct of fire and the measurement of the deviations and time of flight is intended. No addition to the instruments now

furnished the battery is contemplated in order to permit a graphical solution of the problem. The figures listed under the column of observed data represent the average of five normal rounds which will hereafter be treated as one round and referred to in the singular.

On a piece of cross-section paper (Fig. 1) plot a section of the trajectory, to any convenient scale, by the natural coordinates of horizontal range and altitude. B is the TSP, that is, a point on the 900-mil trajectory for a fuse range of 12. A and C are points on the same trajectory for the next higher and lower fuse ranges (13 and 11, respectively). The coordinates of these points are obtained from Part 2 of the firing tables. Draw the line of position to the TSP through B which, as shown by the firing tables, has an angular height of 808 mils.



To plot the point of burst.

If an additional plotting board similar to the trajectory chart be constructed, an alidade might be laid on an angle of 818 mils and the horizontal range to the point of burst (which is not determinable by any instrument now issued the service) determined from the projection of the intersection of the alidade and the altitude line, H = 4300, where the burst occurred. Or, the horizontal range might be computed from the trigonometric relation, Hor. Range = H cot S. The method of locating

the point of burst herein proposed has the advantage of localizing all operations on one plot and of obviating the use of logarithmic tables.

The point of burst was 10 mils high, which, at a range of 5810 yards (actual range to B) is 58 yards. Move a compass set to a radius of 58 yards along the altitude line of the point of burst (H = 4300) until its arc is tangent to the line of position to the TSP. The center of the arc, D, is the first approximation of the position of the point of burst. The point of tangency is 168 yards beyond B so that the actual range to the burst is 5810 + 168 = 5978 yards. A more accurate value of the deviation corresponding to the 10 mils is thus shown to be 60 yards and a more exact location of D, as D′, may be made using this value as a radius. Generally this differential will be of the order of a yard or so, as in the present instance, and it will be sufficiently accurate to accept the first approximation.

To eliminate wind effects.

In the normal course of engaging an aerial target, the effects of wind are automatically corrected for. No such corrections were applied to the trial shot data, so, of necessity, the part the wind played in moving the bursts from B to D′ must be examined and a new point of burst determined which would be the point of burst in still air.

The tabulated data shows that a wind of 20 miles per hour was blowing at an angle of 1066 mils (60°), following, with the plane of fire. A wind normal to the plane of fire would have no range component and hence no effect on altitude. For this reason it is prescribed that trial shots shall be fired with a wind-fire angle of 90° since it is desired that altitude corrections be most accurately determined. Faithful adherence to this principle necessitates a 360° field of fire, a condition seldom, if ever, attainable in times of peace. In the example being considered a wind-fire angle of 60° is selected for illustration. The range (following) component of the wind is

$$W_R = W \cos \phi = 20 \times 0.5 = 10 \text{ miles per hour.}$$

Entering Part 5*d* of the firing tables, "Differential effects for Rear Wind," with elevation 900 mils, time of flight 14.5 seconds, and wind speed 10 miles per hour as arguments, the two differential effects with which the problem is concerned are determined to be:

Increase in horizontal range (following wind): 38 yards.
Increase in altitude (following wind): 8 yards.

The corrected point of burst E may now be plotted 8 yards lower and 38 yards to the left of D′. This corrected point of burst is 14 mils high, or

$$S = 808 + 14 = 822 \text{ mils.}$$

To obtain the ballistic altitude.

The problem now is to move the burst from E to B by such altitude and fuse range changes as may be necessary. Reversing the conditions, if the target be at E, the data determined must be that applicable to B — the problem is the same but the solution thereof is more readily comprehended if it be regarded in that light. Let us examine how an altitude correction enters the position finding system. The fuse range curves of the AA Data Computer, Model 1917 (Corrector R. A.) are constructed with angular heights as abscissae and altitudes as ordinates. If the altitude be altered without a corresponding change in the angular height the effect is to slide the burst along the line of position for that angular height. This is the case when altitude corrections are applied to the Model 1917 Data Computer since the altitude ordinate is changed by the application of the correction, but the abscissa of angular height is established by the vertical sight and is changed only when the target changes position.

From E construct a line of position having an angular height of 822 mils. This line intersects the trajectory at F at an altitude of 3865 yards. The altitude correction necessary to bring the burst from E to a point F on the desired trajectory is the altitude difference between E and F.

$$H_E - H_F = 4292 - 3865 = 427 \text{ yards},$$

or, in percentage, $$\frac{H_E - H_F}{H_E} = \frac{427}{4292} = 10\%,$$

the correction being negative since the burst was high.

To correct the fuse range.

The burst is now on the trajectory, but is 465 yards short of the TSP. A supplementary table to the present firing tables, entitled "Change in corrector setting for 1-mil change in angular height," has been prepared and issued to Antiaircraft organizations, whereby the mil value of the divergence between the lines of position to E and to the TSP may be converted into units of the corrector to effect the range change from F to B. However, if the target be imagined at E and an altitude correction of — 10% to have been applied, the Data Computer will actually cause a fuse range to F to be read, which in this instance would be 10.9. While the proper corrector change would increase this value to 12 on the fuse, still the value read and utilized in the determination of superelevation would be 10.9. An error in superelevation amounting to some 13 mils would exist.

An additional differential table is required showing the effect on horizontal range due to a change of $^1/_{10}$ of one fuse setting. Such a table would give 35.4 yards for that portion of the trajectory from which this

problem is taken. Since the total change in horizontal range from F to B is 375 yards, the total change in fuse setting required is

$$\frac{375}{35.4} = 10.60 \text{ tenths} = 1.1 \text{ whole fuse settings.}$$

The Data Computer would furnish a fuse range of 10.9, as mentioned previously, which, when increased by the correction of 1.1 would result in a fuse range of 12. The burst is now on the TSP.

It is unnecessary to point out that a flat correction is true only for one position on one trajectory. Altitude corrections have been made in percentages since 1917. The pointer from which fuse ranges are read must be made adjustable and provision must be made whereby the adjustment will be in percentages.

$$\text{In percentage, } \frac{1.1}{10.9} = 10.1\% \text{ increased.}$$

To determine the time of flight correction.

In computing the deflections, vertical and lateral, for antiaircraft fire, rates of angular travel are multiplied by times of flight. If the time of flight actually established by the projectile in flight does not agree with the range table time of flight as read from the Data Computer, then the deflections resulting will not be correct. If the projectile has a duration of flight greater than range table conditions the uncorrected deflections would be too small, and *vice versa.*

Part 1 of the firing tables lists the horizontal range and altitude of points on the trajectories for each second of time of flight The time points with which the problem is concerned (12, 13, 14, and 15) may be plotted on the trajectory from the data obtainable from this table. The point for a time of flight of 14 seconds on the next higher trajectory ($i = 1000$) will be required and should be plotted at the same time and a reference line drawn connecting the two 14-second points. Reference lines should be drawn also from E and D′ to the trajectory and parallel to the 14-second line.

The assumption on which the first time of flight correction will be developed is that E and D′ lie on trajectories which, within the brief limits covered by the plot, may be considered exactly similar and parallel to ABC and to the 1000-mil trajectory. Points of equal time on the trajectories will lie on parallel lines as, for example, the reference lines just constructed. Although the time difference *d′e* is negligible, on the summit of a trajectory and in a high wind it might be, conceivably, of considerable magnitude. Computation for this difference will be included for demonstration. The time difference between D′ and E, which is repre-

sented by *d'e* may be determined by inspection to be approximately 0.1 second. The time actually established by the projectile at E, then, is

$$14.5 - 0.1 = 14.4 \text{ seconds.}$$

Range table conditions at E are represented by the point *e* which, by inspection, has a time of flight of 14.3 seconds. Since the range tables or, more properly, firing tables, as represented by the Data Computer, would give a time of flight of 14.3 seconds whereas the projectile would travel 14.4 seconds before bursting, the first correction is seen to be a ballistic correction of

$$14.4 - 14.3 = 0.1 \text{ seconds increased.}$$

This correction also is negligible but the value will be continued for illustration.

The time of flight cylinder of the Model 1917 Data Computer is actuated by the same mechanism as the fuse range cylinder, and the altitude correction of — 10% previously deduced would have an effect on time of flight similar to that on fuse range. The target being at E with an altitude correction of — 10% applied, the time of flight read would be that applicable to range table conditions at F, or 12 seconds in this instance. The experience of firing the problem has shown that the range table conditions should be increased by 0.1 second (the first correction). In addition, the range has been increased from F by 11 tenths of a fuse setting. A differential table to indicate the relation existing between tenths of one fuse setting and seconds time of flight is required, similar to the present table "Change in time of flight for change of one division in corrector setting." Such a table would show, for that portion of the trajectory being studied, that $^1/_{10}$ of one fuse setting corresponds to 0.16 seconds. The second correction, then, which corresponds to the range change previously computed, would be

$$11 \times 0.16 = 1.76 \text{ seconds increased,}$$

and the total correction becomes

$$1.76 + 0.1 = 1.86 \text{ seconds increased.}$$

$$\text{In percentage, } \frac{1.86}{12} = 15.5\% \text{ increased.}$$

This value is very high. Trial shots fired on the ascending branch of the trajectory are quite likely to lead to corrections of considerable magnitude.

The necessity for a time of flight index adjustable in percentages is apparent. The question is identical with that of the fuse range index.

To determine the lateral error.

There is no necessity for a graphical representation of the lateral deflection problem. The projectile deviated from the plane of fire due to

two causes, wind and drift. These two effects may be determined from the firing tables and added algebraically, the resultant compared with the observed deviation, and any disparity between the two cared for by a lateral deflection adjustment.

The deflection component of the wind is

$$W_D = W \sin \phi = 20 \times 0.86 = 17.2 \text{ m. p. h.}$$

Entering Part 5c-1 of the firing tables with a time of flight of 14.5 seconds and elevation of 900 mils as arguments, the deflection of the projectile due to a 10-mile wind is determined to be 30 yards. In a 17.2-mile cross wind blowing from right to left, the projectile was deflected

$$1.72 \times 30 = 51.6 = 52 \text{ yards to the left.}$$

Using the same arguments the drift is determined from Part 3 to be 40 yards to the right. The observed deviation, the resultant of these two effects, should be

$$52 - 40 = 12 \text{ yards left.}$$

The lateral deviation recorded is two mils left which, at a range of 5978 yards, corresponds to a deviation of 11.8 yards left. Therefore there is no lateral error.

To adjust the trial shot corrections through changing air densities.

When a battery is so situated that its action is intermittent, trial fire should be conducted prior to each engagement. Batteries protecting the battle zone are in action almost continuously and are thereby prevented from conducting trial fire oftener than two or three times per day. If the first trial firing be conducted at daybreak and the second at noon, some effort must be made to vary the corrections with the atmospheric changes that occur in the interim. The departure from range table conditions is due to two general causes, atmospheric and materiel. The materiel cause, such as wear of the gun and peculiarities of the lot of ammunition being fired, may be considered as constant during the period between trial firings; and the atmospheric cause may be varied from time to time by means of data furnished by the firing tables. Thus a progressing adjustment is possible.

The meteorological message showed the air density to be 5% below normal. From Part 5c of the firing tables the effect of variations in air density on horizontal range and altitude may be ascertained. Specifically these effects, for a 5% decrease, are + 66 yards in horizontal range and + 78 yards in altitude. Point E′ may be plotted 78 yards below and 66 yards to the left of E. This is the point of 100% atmospheric density. The deviation of the projectile from B to E′ is due to materiel causes and is assumed constant in the interim between firings. Should the air

density change materially prior to the succeeding trial firing, the effect of the change from 100% to the new ballistic density may be determined from the firing tables. With E′ as a basis the horizontal range and altitude changes so determined would result in the plot of a new point of burst, from which a re-determination of the corrections could be effected.

A study of the errors of the mathematical method.

The text books of Antiaircraft Artillery prescribe a mathematical method of computing the trial shot corrections and dictate that the trial firing shall be at the summit of a trajectory. If it be assumed that the prescribed conditions be violated by the use of the TSP which forms the basis of the graphical solution just completed and which is not on the summit of a trajectory, then the errors of the mathematical method under those conditions may be illustrated on the graph.

The first correction that would be determined would be for the difference in altitude between E and B. The application of this correction would move the bursts along the line of position to G. The determination of the corrector change corresponding to the angular divergence between the lines of position to E and B and the application of that correction would move the bursts out to K (GK = FB). If the target be assumed at E, the correct solution of the problem requires that the data determined be applicable to B since the firing at B actually produced bursts at E. This condition is fulfilled in the graphical solution, but in the mathematical solution just summarized, the fuse range set on the projectile would be applicable to K, some 375 yards over, whereas the superelevation would be computed from the fuse range applicable to point G. There would result an error in range amounting to about 375 yards and in quadrant elevation to some 10 or 15 mils. If, however, the inhibitions of the mathematical method be followed and the TSP selected on the summit of a trajectory, then G and F will be practically coincident and the solution will be correct.

The mathematical method prescribes that a burst high (in vertical deviation) shall be treated as short (in range) and a burst low, as over. This is correct whatever the position of the burst. For example, the burst E was over, actually, yet since it was high in vertical deviation it must be considered as short in range under the rule. This inconsistency is explained by noting the effect of the altitude correction which reduces any burst high, to a position on the trajectory short of the TSP whatever its position prior to the application of the correction.

In order to examine more fully into the agreement between the two solutions, a trial shot problem for the summit of a trajectory will now be developed. The two parallel solutions will be presented with the briefest of explanations.

	Symbol	*Unit*	*Preliminary Data (TSP)*	Observed Data
Fuse Range	B		18	
Altitude	H	Yards	2894	3000
Angular height	S	Mils	408	418
Quadrant elevation	i	Mils	600	
Time of flight	t	Sec.	19.98	20
Vertical deviation	VD	Mils		+ 10
Lateral deviation	LD	Mils		R 5
Wind speed	W	m. p. h.	20	
Wind direction		Mils	3200	
Plane of fire		Mils	1066	
Wind fire angle	ϕ	Mils	1066	

$$W_R = W \cos \phi = 20 \times 0.5 = 10 \text{ miles per hour.}$$

$$W_D = W \sin \phi = 20 \times 0.86 = 17 \text{ miles per hour.}$$

The Graphical Solution (Fig. 2)

1. To plot the point of burst and eliminate wind effects.

Bursts 10 mils high at a range of 7948 yards are 80 yards high. D is plotted from this value. From the firing tables the wind effects for a range wind of 10 miles per hour are determined to be + 12 yards in altitude and + 69 yards in horizontal range. Knowing these two effects enables E to be plotted.

2. To determine the ballistic altitude.

The angular height to E is computed to be 419 mils. The line of position to E intersects the trajectory at F at an altitude of 2890 yards.

$$\text{Altitude correction} = \frac{H_E - H_F}{H_E} = \frac{2988 - 2890}{2988} = 3.28\% \text{ decreased.}$$

3. To determine the fuse range correction.

One-tenth of one fuse setting corresponds to 32 yards at the TSP. The horizontal range change from F to B is

$$6840 - 6591 = 249 \text{ yards increased.}$$

$$\text{Fuse range correction} = \frac{249}{32} = 7.8 = 8 \text{ tenths increased,}$$

$$\text{or, in percentage,} \quad = \frac{0.8}{17.2} = 4.65\% \text{ increased, 17.2 being}$$

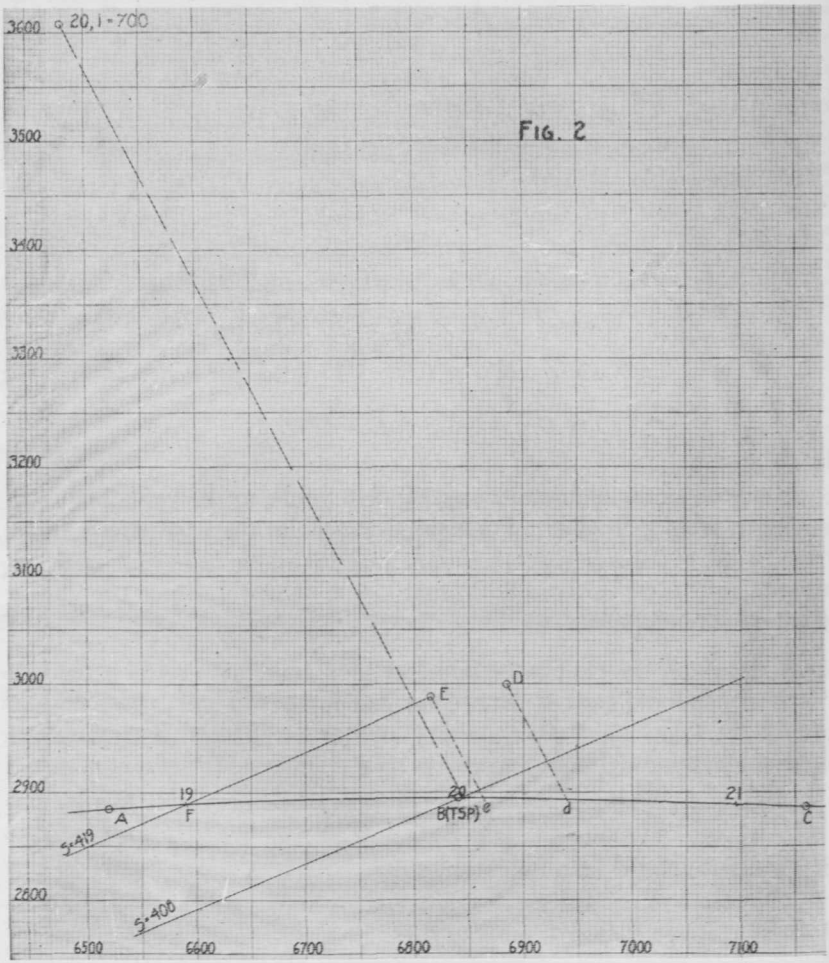
the fuse range to F.

4. To determine the time of flight correction.

The time difference *de* is 0.3 seconds, so that the corrected time to E is

$$20 - 0.3 = 19.7 \text{ seconds.}$$

The range table time of flight to e is 20.1 seconds, which results in a first, or ballistic, correction of $20.1 - 19.7 = 0.4$ seconds decreased.



One-tenth of one fuse setting corresponds to 0.13 seconds at the TSP. Therefore the second correction is

$$8 \times 0.13 = 1.04 \text{ seconds increased.}$$

Total time of flight correction $= 1.04 - 0.4 = 0.64$ seconds increased,

or, in percentage, $= \frac{0.64}{19} = 3.37\%$ increased, 19 being the time of flight to F.

5. To determine the lateral error.

The wind and drift effects are shown by the firing tables to be 82 yards left and 108 yards right respectively. The resultant of these two effects is 26 yards right. The burst occurred five mils right which, at a range of 7948 yards, is 40 yards right.

Lateral error of sight $= 40 - 26 = 14$ yards $= 2$ mils right.

The Mathematical Solution

1. To determine the ballistic altitude.

The wind effect on altitude is determined from the firing tables to be $+$ 12 yards.

Altitude correction $= \dfrac{(3000 - 12) - 2894}{(3000 - 12)} = \dfrac{94}{2988} = 3.14\%$ decreased.

2. To determine the fuse range correction.

The wind effect on angular height is shown by the firing tables to be 2.1 mils, which would be lowered, since the wind was following. The vertical deviation without wind would have been

$$10 + 2.1 = 12.1 \text{ mils high.}$$

One division of the corrector at the TSP corresponds to 1.7 mils in angular height (from the firing tables).

Fuse range (corrector) correction $= \dfrac{12.1}{1.7} = 7$ divisions of the corrector decreased, since a decrease in corrector increases the range and the burst was high (short),

or in percentage $= \dfrac{0.7}{18} = 3.92\%$ of the fuse range increased.

3. To determine the time of flight correction.

One division of the corrector corresponds to 0.13 seconds at the TSP (from the firing tables). Therefore the total change in time of flight due to increasing the range by seven divisions of the corrector is

$$7 \times 0.13 = 0.91 \text{ seconds increased,}$$

and the corrected time of flight to the point of burst is

$$20 + 0.91 = 20.91 \text{ seconds.}$$

Time of flight correction $= \dfrac{20.91 - 19.98}{19.98} = 4.65\%$ increased.

Since the computation of the lateral error is identical for both solutions, it is unnecessary to repeat it.

In the development of the mathematical solution of the problem it was not necessary to resort to the use of the old formula for the determination of the differential wind effects since these are now included in the tables. The comparison of the two solutions which follows indicates a

close agreement in results, which was predicted in the cases when the TSP is taken at the summit of a trajectory:

	Graphical Solution	*Mathematical Solution*
Altitude Correction	— 3.28%	— 3.14%
Fuse Range Correction	+ 4.65%	+ 3.92%
Time of Flight Correction	+ 3.37%	+ 4.65%
Lateral Deflection Correction	2 mils left	2 mils left

The graphic method is more accurate than the method now standard throughout the service. Furthermore, the picture it presents of the problem being solved assists greatly in arriving at correct conclusions and renders the problem of preparation of antiaircraft fire easier of instruction. In point of time required for a solution it probably suffers by comparison with the older method unless the time for preparation of the chart be excluded, since the chart may be prepared beforehand, in which event the two solutions are about on a parity.

The need for time of flight and fuse range indices adjustable in percentages must not be charged against the desire to introduce a graphical method of trial shot solutions. This modification in the position finding apparatus is necessary whatever be the method of determining corrections if the corrections so determined are to be accurate throughout the extent of the field of fire.

The efficacy of antiaircraft fire varies directly with the excellence of the preadjustment by trial shots. It is hoped that the graphical method will enable the trial shot solution to be made most easily and most accurately.

ADDENDUM

A PROVISIONAL GRAPHICAL SOLUTION

The foregoing method is based on hypothesis that the most accurate method of computing corrections at one point in the heavens to be used in firing at another point is the altitude correction method. Being the most accurate method, it is to be preferred. It requires, however, adjustable time of flight and fuse range pointers on the Data Computer, which are not now available. The following provisional method is, therefore, suggested:

Plot the point for the same fuse range as the TSP (12) on the next higher trajectory and draw a line connecting this point with the TSP. It is assumed that this line contains all points of equal fuse range (12). Obviously the locus of all points of equal fuse range is an irregular curve, but for the purposes of the problem, and within the limits thereof the assumption given is justified. Then, if the quadrant elevation of the gun be changed, the burst being at E, the burst will move from E parallel to this fuse 12 reference line.

From E draw a line parallel to the fuse 12 line until it intersects the trajectory at some point e' (not shown on Fig. 1) at an altitude of 4212 yards. The altitude change from E to e' is 4292 — 4212 = 80 yards.

Part 5a-2 of the Firing Tables gives the effect on altitude of a 10-mil change in angle of elevation which, at the TSP, is 40 yards. If, then, it is desired to move the burst from E to the trajectory by a change in quadrant elevation, it will be necessary to change by

$$\frac{80}{40} \times 10 = 20 \text{ mils decreased.}$$

This may be applied as a secondary vertical correction to the sight.

The burst is now on the trajectory and slightly beyond the TSP. (The coordinates of e' are H = 4212, X = 4184.) It may be moved back to the TSP by a corrector change computed from the relation between 1/10 of 1 fuse setting and yards horizontal range as the fuse range correction was computed in the altitude correction method.

It is true that the error in superelevation previously discussed will exist in this solution. However, e' will be, normally, so close to the TSP, that the error will be very small.

Notes On German Army Maneuvers, 1924

MAJOR ALLEN KIMBERLY
Coast Artillery Corps
Military Attaché Berlin (Sept., 1924)

GENERAL

THE maneuvers of the German Army are held through the country in September, this month being climatically well suited, the harvest is over, eliminating damage to crops, and the troops have gone through the spring and summer training with the maneuvers as the climax.

Location.—These maneuvers were held in the neighborhood of Küstrin to the north and on both banks of the Oder. The country is slightly rolling farm land with some woods and an occasional stretch of fairly rough country. The location was chosen on account of favorable and varied ground, a proximity of troops engaged, and to make a rotation of maneuver ground, giving the people the advantages and disadvantages of the presence of a large number of troops, such as local purchases, familiarizing the people with the Army, and distributing property damage throughout the country.

The chances of use of this location as an actual battlefield are very slight,—the only possibility being in a losing war against Poland. The troops generally were not familiar with the terrain.

Significance.—The political significance was slight, though the presence of so large a body of good troops in the neighborhood will make a healthy impression on communistic elements in Berlin as well as any brewing *putsches* from any party, right or left.

Problems.—There were two problems worked out; the first by the 3rd Infantry Division alone in the neighborhood of Bärwalde, north of Küstrin, and on the right side of the river Oder; and the second in the neighborhood of Reichenow, where the 2d Cavalry Division, reinforced by one regiment of the 2d Infantry Division, opposed the 3d Infantry Division.

Parade.—The maneuvers terminated with a parade (as all German maneuvers always do) at Strausburg in which all troops, without trains, passed in review before the Commanding General of the Reichswehr, His Excellency General von Seeckt. Both parade and the maneuvers were the largest yet undertaken by Germany since the war.

Object.—The object was (a) to practice and solve problems in *war of movement* with the very limited means permitted the Reichswehr; (b)

EDITOR'S NOTE: It is to be borne in mind that these notes were made in 1924.

to give as much experience as possible to all officers and troops in war conditions, using as many commanders and staffs as possible for practice in troop leading and tactics; and (c) to specialize in flanking operations, which is and has been the German school of tactics.

WELL CAMOUFLAGED MACHINE GUN IN ACTION
CREW 3-MEN WELL CONCEALED

Umpire Service.—The umpire service was very thorough; each unit to the company had with it a reliable noncommissioned officer, as assistant umpire, who was trained in the work and could make local decisions. The larger units had officers up to and including General officers. Umpires were in automobiles or mounted, and assistants with Infantry on foot. Communication between umpires was by telephone, motorcycle, bicycle, mounted men, and visual signalling.

An elaborate telephone net was placed over the entire maneuver ground by the signal troops during the two days preceding the maneuvers, and where practical the telephones in public service were hooked into the net, such as railway and police stations and post offices.

The umpires in unison made a map study of the ground and maneuver problems in Berlin previous to the maneuvers, preceded the troops to the ground one day, and were well versed in their duties. The umpire service impressed one as being thorough, sufficient, and efficient. Decisions were given with promptness and judgment. White bands were worn on hats and arms of all in this service.

POINT OF ADVANCE GUARD

Identification.–All troops wore the German steel helmet — Reds, plain; Blues, with blue cloth band.

Forbidden equipment.—None of the following equipment was actually used, being forbidden by the Peace Treaty: airplanes, airships, balloons (of any kind), gas (or simulation thereof even to gas masks), heavy artillery, accompanying and anti-tank guns, sound and flash ranging, tanks, antiaircraft artillery, bicycle and motorcycle companies. The number of machine guns was limited. (See Peace Treaty decisions of Council of Ambassadors.)

Simulation of forbidden equipment.—*a. Aviation.*—An officer specially marked, and generally an ex-aviator, was permitted to ride on a motorcycle unmolested through and around the opponent's line. Returning he reported in writing to a designated umpire the result of his supposed aerial flight,—the umpire permitting so much or all of the report as would be in keeping with an actual aerial flight to be transmitted to the commander sending out the aviator.

b. Anti-tank guns were made of wood and stovepipe with sights.

c. Airplanes.—None in Reichswehr, but low powered commercial aeroplanes en route to and from Poland and Königsberg circled the field daily, and machine-gun fire thereon was simulated by the side over which the aeroplane happened to be.

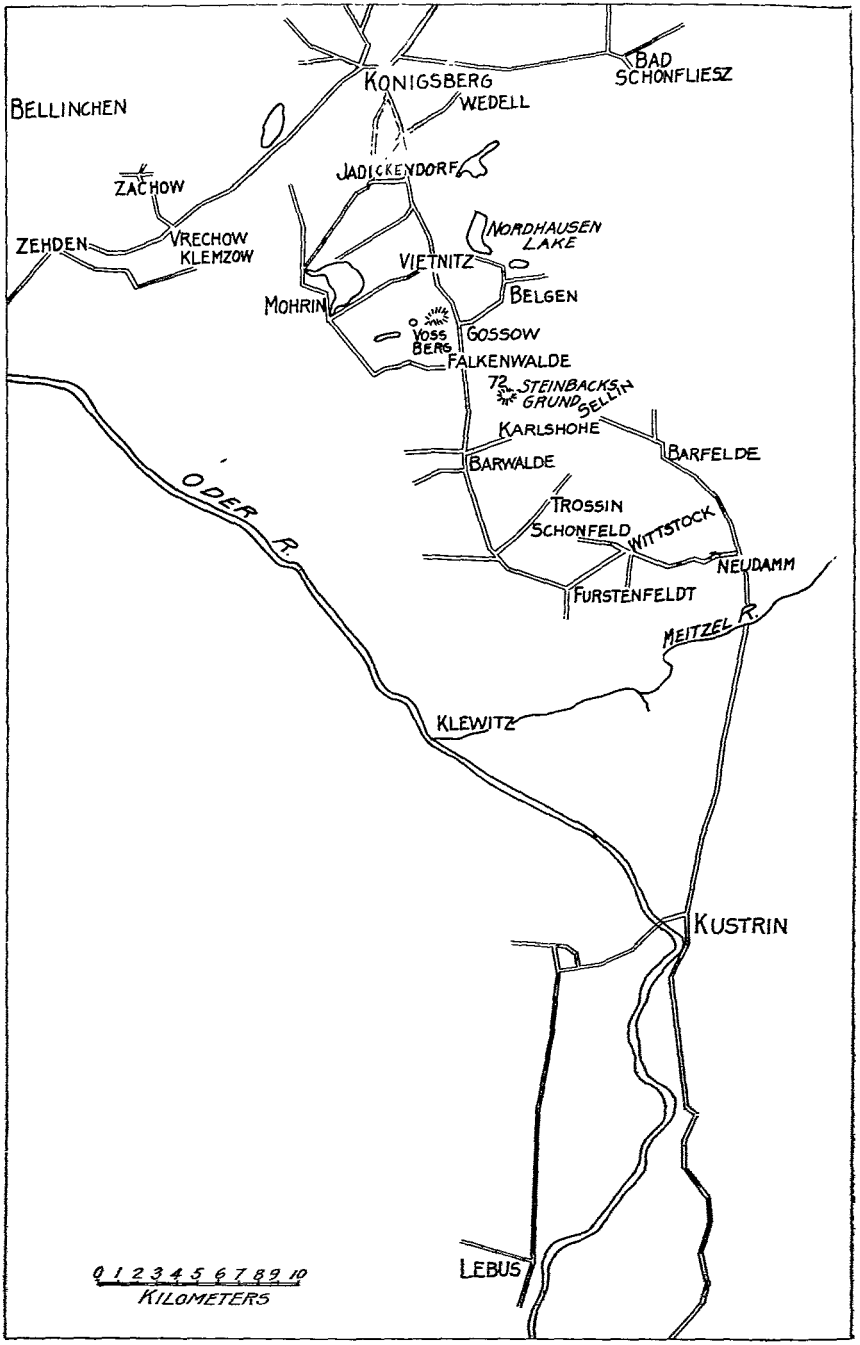
d. Tanks.—Frames of small tanks were made of light wood, covered with canvas, camouflaged, placed on wheels, and pushed by men inside.

First Problem, September 4-6, 1924

Plan of Maneuvers.—Strong Red forces were assumed to be in a defensive position on the Oder with left wing in Peetzig Forest (18 kilometers west of Königsberg, Neumark), opposed by superior Blue forces, who expect a decision on the south wing. Work was being done on the north front of the Blue fortress Küstrin along the Mietzel between Kerstenbrügge and Klewitz. There was no long-range artillery in the fortress.

To protect the fortifications in process of construction, the main Küstrin reserve (Blue) had been transferred to the north; and on the evening of September 3 the bulk of this reserve was in the sector Schönfeld-Fürstenfelde-Wittstock. The line Bärfelde-Waldstücke south of Sellin-Bärwalde was protected. That night the leader of the main reserve was informed that Field Command III (the right Corps of the Blue Army) had succeeded in crossing the Oder with strong units and gaining ground on the east so that its extreme right was in the neighborhood of Wrechow on the Zehden-Gr. Mantel highway, opposite the south wing of the enemy forces, and was directed to assist in the attack of Field Command III by leaving Trossin at 7:00 A. M., September 4, and advancing via Sellin to Bad Schönfliesz in the rear of the enemy.

On the Red side, the reinforced 1st Infantry Brigade arrived after a strenuous march, on the evening of September 3, in the sector Königsberg-Jädickendorf-Wedell. The leader was informed that the enemy had forced a crossing at Bellinchen and south thereof and had reached the approximate line Bellinchen-Zachow-Wrechow with advance units, and was directed to take over the right (Red) flank protection.


BELLINCHEN
KONIGSBERG
WEDELL
BAD SCHONFLIESZ
ZACHOW
JADICKENDORF
NORDHAUSEN LAKE
ZEHDEN
VRECHOW
KLEMZOW
VIETNITZ
BELGEN
MOHRIN
VOSS BERG
GOSSOW
FALKENWALDE
72
STEINBACKS GRUND
SELLIN
KARLSHOHE
BARFELDE
BARWALDE
ODER R.
TROSSIN
SCHONFELD
WITTSTOCK
NEUDAMM
FURSTENFELDT
MEITZEL R.
KLEWITZ
KUSTRIN
LEBUS
0 1 2 3 4 5 6 7 8 9 10
KILOMETERS

Blue was to commence the march from Trossin via Sellin to Bad Schönfliesz, while Red advanced along the Königsberg-Vietnitz-Bärwalde highway. An encounter was to ensue in the neighborhood of Gossow-Falkenwalde, during which Blue gradually pressed Red back.

The attack of Field Command III made only minor gains of territory during the day, the enveloping movement undertaken via Klemzow-Dölzig being, on the whole, a failure, due to the arrival of Red reinforcements, Blue therefore passed to the defensive and the Main Reserve, Küstrin, in the area Sellin-Bärwalde, was directed to cover the unloading of the reinforced 4th Division, to arrive on September 5.

Red assumed the offensive and on September 5 the reinforced 1st Infantry Brigade was given reinforcements and directed to attack.

Blue, who on the afternoon of September 4 had placed outposts on the Defileen Lakes, north of Vietnitz, attempted at first on September 5 to halt the enemy with parts of his forces in the positions gained the day previous. Red prepared to make an attack between Mohriner Lake and Nordhausener Lake. Blue avoided this attack and gradually withdrew to the position prepared by his main forces in the neighborhood of Sellin-Bärwalde. Red followed, making careful reconnaissance, and prepared to attack on September 6.

Combat operations continued during the night. Red attacked at dawn, September 6, and pushed his way into Blue's position, carrying the attack far into Blue territory. Blue defended to the end of the maneuvers.

Operations

Actual Operations September 4.—Officers and umpires assembled at Sellin for the first problem at 6:00 A. M., September 4. The Blues had established an outpost on the line Bärwalde-Bärfelde on the night of the third and had thrown out patrols but did not establish contact.

The advance guard, in normal formation with a few cavalry flankers, crossed the outpost line with a thin cavalry screen, about 1 to 1½ kilometers in advance, at 7:15 A. M.

At 8:45 A. M. Red Cavalry patrols were observed in a northwesterly direction, and the support of the advance guard deployed north of Sellin with one battery of artillery. No contact was established; patrols disappeared to the northwest, and the direction of march was changed to northwest, toward Falkenwalde. Isolated shots were heard on the Blue right flank (evidently patrol skirmishes), Red patrols being observed by Gossow at 10:25 A. M. going east.

It was then learned that the Reds had advanced and established their right flank with one battalion and two batteries at Voss-Berg, a hill west from Gossow, and thrown out lines of resistance to the front in a westerly

direction on both sides of the highway; the other two battalions taking the Vietnitz-Belgen road, attempting to turn the Blue right flank. At 10:50 A. M. one Red battery north of Gossow opened fire on the deployed Blue advance guard. (Commercial type airplane circled field at 11:20 A.M.

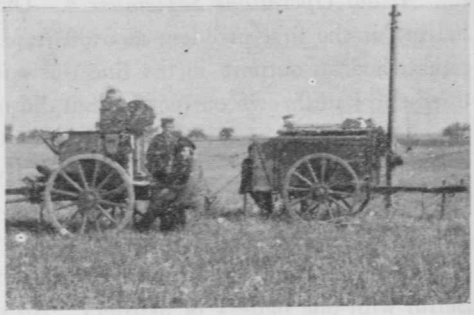
77's in Position

The Red Commander now having learned that the Blues were more in strength than he had supposed, changed his plans with reference to the two flanking battalions on the Vietnitz-Belgen road and sent one to support his right flank at Voss-Berg, the other to his left flank for an eventual counter attack on Blue's right flank.

The operations in the neighborhood of Voss-Berg were carried on with artillery and machine-gun fire, with the Blues advancing cautiously. At 12:00 noon there was a lull in the operations for about an hour while Blue prepared for the attack and reconnoitered the ground. At 1:00 P. M. the attack was made, and the Blue main body, supported by its artillery, took Voss-Berg at about 1:20 P. M., the Reds withdrawing to the north.

At this time the maneuver was suspended and critique held. (United States Military Attaché not present at critique.)

Leaders were then changed and Red and Blue were disposed according to the previous plans. The action continued in the form of light skirmishes, the Reds being given time to withdraw toward Vietnitz, where they took a position at dusk closely followed by the Blues. Operation then ceased for the night.



Field Radio Set

That evening the Blues, having received word that the main Blue attack on the Red main left wing had met with little success, were directed to cease the offensive for the present. Accordingly the Blue Commander took up a defensive position north of Vietnitz. Outposts were kept out until 9:00 P. M., when the day's operations ceased.

Actual Operations, September 5.—The Red Commander also learned of the small success of the Blue main forces against the left flank of the

main Red forces and, in addition, that reinforcements were being received on the main Red left flank for a counterattack. The Red Commander was also informed that he could expect reinforcements of Staff, two battalions and Trench Mortar Company of the 8th Infantry, and two light batteries of artillery, and was directed to take the offensive and throw back the Blues in the direction of Küstrin.

The Blue Commander received information that the 4th Division of the Blue main body would be taken from its left wing and be sent by rail and detrained at Neudamm and Fürstenfelde, and that his problem would be to protect this detraining in line not nearer them than the line Sellin-Bärwalde.

Accordingly the Red Commander made the decision to attack and to attempt to interrupt the detraining of the Blue 4th Division.

The Blue Commander decided to defend in successive positions, in echelon and in depth beginning north of Vietnitz, with one battalion, the other three battalions disposed, one north of Falkenwalde and two in the main line of resistence, the right flank lying north of Sellin and the left at Steinbachsgrund No. 72. (This position was later given up, having been found to be too near the main defensive line.)

The Red attack began at 11:00 A. M. against the Blue forces in position north of Vietnitz; the latter's flanks being protected by the lakes, only a frontal attack was possible. The Blues retreated, resisting as stubbornly as possible, supported by artillery and causing frequent deployments by action with light and heavy machine guns, light trench mortars, and disposition of infantry and machine guns in depth. The retreat and advance was along and on both sides of the highways toward Gossow.

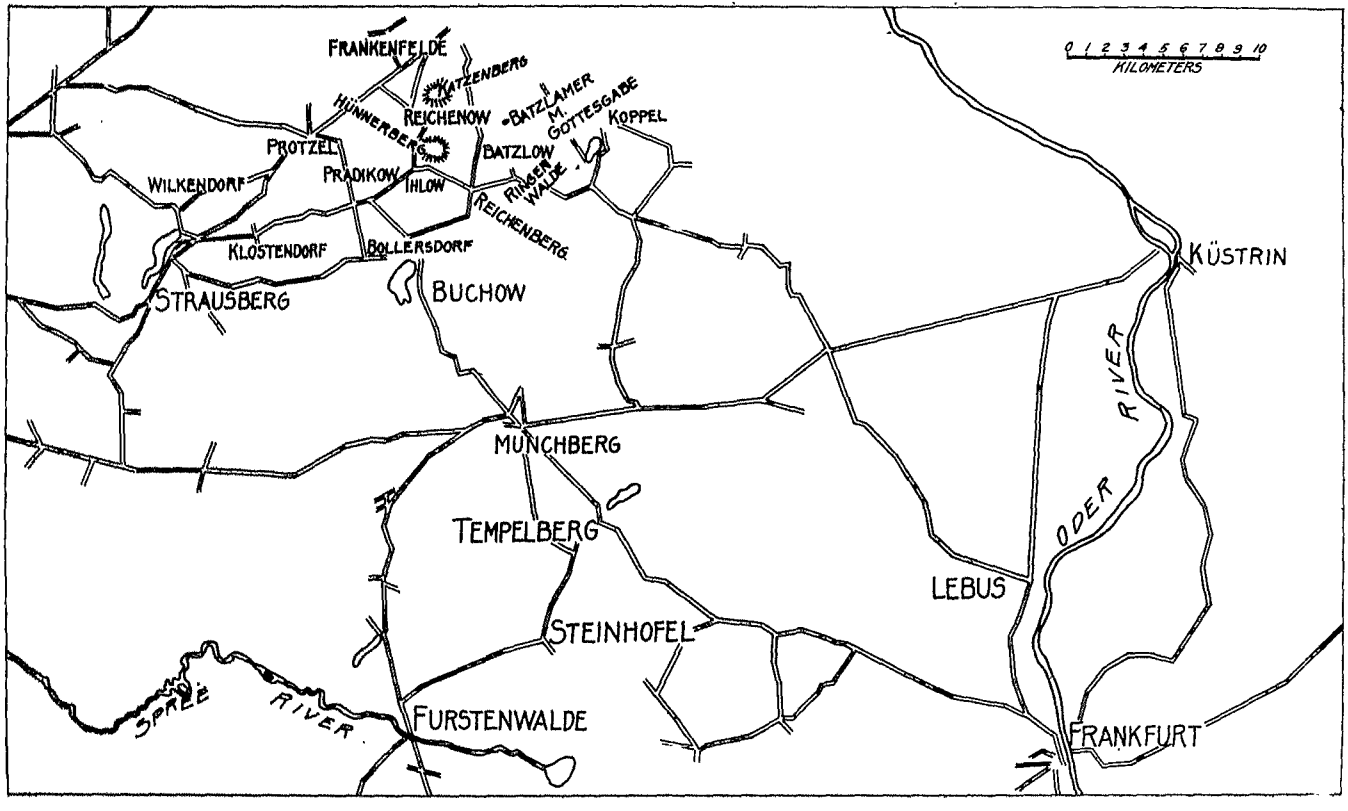
(Commercial type airplanes circled over the forces, one at 11:20 A. M. and one at 3:10 P. M.)

The action was continued in this manner until dark, the main object of the Blues being to give time to the 4th Division for detraining and for fortifying their main and last line of resistance.

The troops bivouaced in position and minor skirmishes were carried on by patrols during the night.

The final line of resistance of the Blues in which the "dug in" was just north of the Sellin-Karlshöhe-Bärwalde road on a ridge. The protection of the road with a depression on each side and a ridge farther to the south gave excellent positions for artillery and reserves.

Actual Operations, September 6.—The position of the Blues was thus on the morning of September 6, which dawned with a heavy fog. The Reds launched a powerful attack at daybreak, supported by all of their artillery and trench mortars. The final attack and breaking through the line occurred shortly after 6:00 A. M. Due to the fog the attack resulted


FRANKENFELDE
KATZENBERG
HUNNERBERG
REICHENOW
BATZLAMER M
GOTTESGABE
KOPPEL
PROTZEL
BATZLOW
WILKENDORF
PRADIKOW
INLOW
RINGER WALDE
REICHENBERG
KLOSTENDORF
BOLLERSDORF
BUCHOW
STRAUSBERG
KÜSTRIN
MUNCHBERG
ODER RIVER
TEMPELBERG
LEBUS
STEINHOFEL
SPREE RIVER
FURSTENWALDE
FRANKFURT
0 1 2 3 4 5 6 7 8 9 10
KILOMETERS

in a series of local attacks and local counterattacks; artillery observation was totally impossible; lateral communication along the skirmish line was difficult; and in several cases direction was lost by smaller units due to the lack of compasses by the noncommissioned officers. The attack was carried through to the artillery positions but was more or less confused due to the fog.

This problem then ended at 6:45 A. M. A critique was held and the troops marched in peace formation to Zellin.

Second Problem, September 8-9, 1924.

Plan of Maneuver.—A Blue army was assumed to be marching toward the line Schwieloch See-Beeskow-Fürstenwalde-Hoppegarten, while a Red

Company Marching in After Hard Day's Work

Army advanced from Posen and, on September 6 and 7, forced a crossing over the Oder in the area Fürstenberg-Frankfurt-Lebus. The Blue advance guard battalions, which had advanced to the river, were pushed back to the Spree and to the line Steinhöfel-Tempelberg-Müncheberg by the evening of September 7. Fortress Küstrin was taken on the evening of September 6 by strong superior enemy forces.

The reinforced 2d Cav. Div. (Blue) had been brought up from West Germany and was concentrated by the evening of September 7 in the area Strausberg-Klosterdorf-Prädikow-Prötzel-Wilkendorf, and had sent out reconnaissance detachments in the direction of the Oder, below Küstrin.

The Army planned to complete its concentration on September 8 and to attack on September 9, with the advance units holding the Spree sector and later the line Steinhöfel-Tempelberg-Müncheberg until the attack. The reinforced 2d Cavalry Division was to prevent the enveloping of the Army left wing by the enemy across the Oder below Küstrin.

Heliograph Section in Action

On the Red side, the 3d Division, which had been employed against the north front of Küstrin, was ordered to cross the Oder near Kienitz and to reach the area north-northeast of Neu Hardenberg on September 7. It was then to prevent the enemy forces reported marching toward Prötzel-Klosterdorf from taking part in the imminent battle of the Army Corps.

Operations

Actual Operations, September 8 and 9.—In the second problem there were no pre-arranged published plans—merely a conference of group commanders with the umpire staff.

Four armored cars were used in this maneuver by the Blues, principally as raiding parties, swinging into and harassing the Red rear. The cars were very fast, about 30 to 40 miles per hour, with stout armor and machine guns.

Heavy Machine Gun

The Blue reinforced cavalry division marched east on highroad Reichenow - Batzlow, with the infantry marching east on the Ihlow-Reichenberg highway. First contact was established at 8:40 A. M. with the advance cavalry patrols and at 9:05 A. M. the entire cavalry division deployed, one brigade as it came over the ridge just northwest of Batzlow (at point Sch.), the other on the opposite side of the highway (the day was clear and sunny and this deployment presented a rare spectacle), the advance detachments having halted in the outskirts of the town proper. The division was then halted at the Reichenberg-Batzlow-Batzlamer road. It was Blue's intention by a

quick advance to take the commanding heights northeast and north of Batzlow, and take up a strong defensive position there. Arriving at Batzlow, the Blue Commander learned that the 7th Regiment of the Reds had captured Ringenwalde and defeated the Blue Infantry there and that the Red main body was advancing along the road Koppel-Gottesgabe evidently in an effort to turn the Blue left flank. The Red advanced parties were also in possession of the heights northeast of Batzlow. The Blues were thereby deprived of their objective and could not counterattack Ringenwalde without seriously exposing their flank to the main Red body.

The Blue Commander then decided to gather all available cavalry troops on his left wing and attack the Red right wing; this idea, however, after a short time was given up and the Blues retreated to line Reichenow-Katzenberg (Katz Mountain). The Blue Infantry had withdrawn from Ringenwalde and fallen back over Reichenberg in line Wachtelberg-Ihlow-Hühnerberg.

At 11:00 A. M. the Red main forces, having taken Batzlow and the dominating hill one kilometer west of this village, were rested after their hard advance and stubborn fight at Batzlow.

The Group Commander, in charge of the maneuvers, here gave the Blue Commander news that the main Blue army, owing to a fierce attack, had been forced to retreat westwardly and that the Blue forces in this problem (2d Cavalry Division, reinforced) had the problem to protect the main Blue left flank in a position Buckow-Prötzel. The Blue forces then retired to this position.

At 4:00 P. M. the Commander of the Reds gave the order to "feel out" the strength and location of the Blue position with a view to an attack early on the following morning and to harass him during the night. Scattered machine-gun and artillery fire was kept up during the night by advance parties all along the line, the troops bivouacing in position, both sides sending out patrols.

The morning of the ninth dawned foggy and found both sides taking the offensive at 6:30 A. M., the Reds attacking with main forces north of Grunow, through Blue infantry holding a defensive position with right flank in Bollersdorf and extending to the north of Prädikow on the highway, and the left wing at the north opened up an offensive with the cavalry division in the neighborhood of Frankenfelde with the intention of attacking with one brigade east of the highway Reichenow-Ihlow and the other west of the road.

At the northern part of the battlefield a cavalry brigade, under cover of fog, took two Red batteries at about 7:30 A. M. near point 86 south of Reichenow, attack carried out part mounted and part dismounted, but were soon thrown back by a counterattack by the Red reserves in the direction of Prädikow. In this area the Red attack had made an espec-

ially big advance by support of several small fake tanks. The cavalry brigade east of Ihlow had turned to the south via Reichenberg in order to get in the direction of Bollersdorf in the rear of the Red's rapidly advancing charge. The advance guard of the Blue met a Red defensive position in a defile west of Pritzhagen, near a brick factory there, and the commander of the cavalry brigade, not desiring to make a long fight in the defile, turned with his main forces over Wachtelberg in the direction of Grunow. At this time the maneuver ceased and there was no further attacking on either side.

ATTACHE WITH GERMAN STAFF OFFICER AT MANEUVERS

(General critique was then held, to which permission to attend was denied the writer.)

OBSERVATIONS

1. Orders were well and efficiently given, both verbally and in writing, and, when practicable, in plenty of time to permit reconnaissance by the troops.

2. Commanders, in action, give orders verbally. Written orders are used until the operation is under way.

3. Orders follow a regular plan, but the plan is flexible as to the number of paragraphs. The first paragraph always gives the information of the enemy and friendly troops; the second and third give the plan of operations; and the last paragraph gives the location of the commander. On the offensive the principle of successive objectives was always used, and the principles of mass, coordination, surprise, and secrecy were observed.

PONTOON BRIDGE CONSTRUCTION

4. After issuing orders the commander or his immediate staff seldom left the C. P. Subordinate C. P.'s were visited by an officer assigned to that staff for that purpose.

5. The only map permitted was the 1:100,000, without contours, elevations given by hachures in meters.

6. Defensive positions were well arranged, reserves well used, and provision made for counterattack.

7. No G-2 work.

8. Supply system seemed to operate smoothly.

9. Attacks were generally well conducted, and communication to rear and laterally was well maintained. The infantry, as a rule advanced and retreated under the sole protection of its heavy and light machine guns, seldom using the rifle in the advance before the assault. The heavy machine gun is used in the assault, and is carried by two men on a sled with handles in front and rear or a light wheeled trailer if the ground is suited.

10. The machine gun operated well with blank ammunition and the supply seemed always sufficient. The machine gun cartridges have hollow wooden bullets and when used a damping apparatus is attached to the muzzle to decrease its size and thus increase the recoil. The bullet is thrown out in splinters doing little harm a few feet away.

11. There are three types of machine guns used:

Heavy water cooled.
Light water cooled.
Light air cooled.

12. Fire control was good for infantry machine guns and trench mortars. Targets well designated. Heavy machine guns seldom opened fire at ranges over 1600 meters or light machine guns over 600 meters.

13. Infantry patrolled efficiently.

14. Troop leading was effective, but direction finding at night and in fog was weak owing to the fact that only officers had compasses.

15. The terrain was reconnoitered as much as possible before an attack.

16. March discipline was good. Troops were not kept under arms unnecessarily.

17. Feet were inspected each night after a march or maneuver.

18. Each regiment had a band of not less than forty-five instruments, so arranged as to permit division into three parts when battalions operate separately.

19. Each division has an Alpine battalion for operations in rough and mountainous country.

20. Dogs were used as messengers. The service was very efficient.

21. The artillery equipment is limited to 77-mm. field pieces (models called old and new at the close of the war) and 105-mm. howitzers. The equipment is war-time stuff, and little or nothing is to be learned therefrom.

22. Artillery positions and observations points were well chosen and communication between them good. Ranges were set and corrected, indirect fire being used practically always.

23. The artillery was on the job and up toward the front, taking every opportunity to get into action.

24. Blanks were fired each shot indicating number of shots, and hits were decided by the umpires.

25. Ranges were taken from map and ballistically corrected. Wind estimated for first shot. No meteorological personnel permitted by the Peace Treaty.

Messenger Dogs

26. Communication between infantry and artillery as follows: Artillery liaison officer, with each infantry regiment, takes with him signal men from his own outfit, number depending upon the distance, and lays and maintains his own line with the artillery C. P. Lines between gun positions and observation posts are maintained by artillery signal men.

27. Artillerymen carry rifles and have machine guns — two to each battery. (Rifles considered superfluous.)

28. Anti-tank weapons and accompanying guns are forbidden by the Peace Treaty. They are made of wood and actual sights are used therewith.

29. Horses and harness well appearing and well kept. Equipment in fair shape and generally camouflaged. Rope traces used throughout.

30. Inside of legs of drivers have heavy leather overboot with steel strip on outside for protection.

31. The cavalry, armed with lances, sabres, and rifles, operated mounted and dismounted. Horses and equipment were in good condition and well kept.

32. The patrolling by the cavalry was very good, as were their screening operations.

33. Signal troops were efficient, wiring quickly done.

Imitation Tanks

34. For transport the German army, since the war, has turned to light, two-horse wagons, except for a few large, wide-tired, six-horse wagons for heavy loads of ammunition. The light wagon was adopted after the lessons learned in the Russian campaigns and the bad roads encountered.

Remarks

Tactics and Weapons.—The tactical problems which were used as a basis for the maneuver have no close relationship with experiences of 1917 and 1918. Germans do not consider the method of position warfare which existed during the latter part of the World War, whereby the higher command exercised considerable influence upon the very smallest units, as the method of combat which a future war will bring. They believe in a greater mobility of the entire operations, in which naturally the tactical judgment and the independent action of the subordinate leader will play a decisive rôle. Therefore the main purpose of their tactical problems is to create situations in which the leaders of small units have opportunity to make independent decisions and to lead their troops according to their own judgment. For this reason situations are generally selected

Armored Cars

in which large armies are assumed to be on the flank, and the leader of the smaller unit is permitted to act independently to a large degree in the execution of his duties.

Consequently the lessons of the World War played no noticeable rôle in the tactical problems of this maneuver. In combat leadership, the impression was that the Combat Regulations, as laid down in the Infantry and Artillery Training Regulations, were thoroughly comprehended by all arms.

Leadership.—Combat leadership on the field of battle, i. e., practical tactics, has forced on Germany certain antiquated practices as compared with the World War and the experience gained therefrom, due to the fact that a large number of arms and technical auxiliaries are forbidden.

Due to the great influence that technics have and must have on tactics, it is easily comprehensible that an army cannot adopt a method of combat fully coinciding with realities if it *must* do without modern weapons. This deficiency can not be replaced by assumption nor by study. Consequently in the attack it is not possible accurately to calculate the time required by the heavy artillery to get into action; the influence of actual tanks, with their numerous practical difficulties, is missing; and, above all, the absence of airplanes is important. Practice in cooperating with airplanes and the activities of enemy aircraft cannot be learned by assuming their presence and cannot be replaced by something else.

Adaptability of Cavalry.—Also, the Peace Treaty forced upon Germany a relatively large amount of cavalry (eighteen regiments of cavalry against twenty-one regiments of infantry). The maneuvers of September 8 and 9 were therefore followed with special interest, as they were to demonstrate a cavalry division in modern warfare. However, the impression was not gained that cavalry in such a proportion is adaptable for modern warfare. Many Germans are of this same opinion, but in practice, due to the Peace Treaty they are obliged to look for a practical solution with these units.

Conclusions

a. The first problem brought out no new principles, the action being simple infantry action, supported by artillery and machine guns.

b. The machine gun was used as the chief infantry weapon in retreat and in advance.

c. The progress of the maneuver was slow and considerable, if not too much, caution was used by both sides. Though faster than actual operations the maneuver went slower than maneuvers usually do. The better and more thorough the umpire service, the nearer are service conditions approached.

d. The cavalry did not make the maximum use of its mobility on the morning of September 9 on favorable ground and a screen of fog; ample opportunities were offered for strong raiding parties in depth which were not taken and which would have resulted in much damage to the enemy.

e. The German soldier makes little or no complaint after many hours of hard work.

f. The cavalry and the artillery soldier appeared overarmed.

g. In view of the decreasing use of the infantry rifle at long ranges and increased importance of machine guns, the weight of the rifle should be decreased.

h. The transport was sufficient and efficient.

i. The scarcity of motor transport was impressive,—it was not depended upon—probably due to the lessons learned by Germany in the

war, by the scarcity of gasoline and rubber in Germany when blockaded, and by the present limitations of the Peace Treaty.

j. According to the United States Army standards:

(1) Training is rated above average.
(2) Discipline, above average, especially when one considers that since the revolution no military tribunals are allowed and soldiers are tried in civil courts for major and minor infringements.
(3) Fighting efficiency, above average.
(4) Staff work and high command, superior.
(5) Orders, superior.
(6) Machine gun action, above average.
(7) Clothing of men, below average.
(8) Clothing of officers, average.
(9) Equipment, average, but old.
(10) Transport, above average.
(11) Endurance and capacity for hard work, above average.

k. Germany, to all intents, is physically disarmed according to the Peace Treaty,

l. The treatment accorded the Attaché was all that could have been expected even of an ex-ally.

Today the Government of the United States determined to take such measures in time of peace as a prudent nation should take, not in the interest of, or with the thought of military aggrandizement, or military aggression against other nations, which the sentiment of our people and the fixed policy of our Government forbid, but in the interest of the preservation of peace among the nations of the earth.—*Secretary of War John W. Weeks.*

French and German War Doctrines

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I

IT is an interesting study, and often a fruitful one, to examine how far a pre-war doctrine proved applicable when the time for testing it in the field arrived. French and Germans had, in the long time between 1871 and 1914, ample scope for full study of the former war, and both nations were facing each other, as the years went on, so much more closely and menacingly that the military authorities of both threw themselves every year more keenly into the formulation of a doctrine that should be as near perfection as possible. They spied upon each other during those years and they studied each other's official war books, while paying possibly still greater attention to the unofficial writings and speeches and lectures given by leading soldiers. They learned from each other, and they were keen especially to note, not without secret glee, what they believed they saw of fault in the future enemy's ideas.

Side by side they were studying also the events of our war in South Africa, of the Russo-Japanese struggle in Manchuria, and probably more than we think of the Balkan War of 1912, and they were learning more, as we too were in Britain, of the connected arts of killing and avoiding being killed. Both parties, dipping into older history, turned up everything that could throw light on Napoleon's victorious campaigns; but both here, and in the study of more recent deeds of war, something different in moral character and in mentality led France and Germany to conclusions that were not identical.

Both sides, naturally, preferred the rôle of attacker to that of defender. Usually, when two countries see war approaching very closely, one of them begins also to see that prudence enjoins a defensive attitude for the very first phase. This may be due to comparative slowness of mobilization, to the nature and configuration of the frontier, to the advisability of awaiting the arrival of an ally or to some other consideration. But, for this great war that began in 1914, both French and Germans seem for long to have made up their minds that they, and not the enemy, would be in a posture for attack at the start. This would affect not only their plans, but would have a repercussion on their very doctrine. The reasons

why each thought himself the chosen attacker may therefore be briefly stated.

France, if facing Germany alone, would be so outnumbered that defense at the start would alone be possible; but France counted on having Russia on her side. She would have then to calculate what force Germany would have to deploy in the East against the slower moving colossus of Muscovy. When this was calculated, she made up her mind that what Germany could bring west would, if not actually inferior numerically to France's own first-line troops, be so nearly on an equality that an initial offensive would be more than justifiable. Without quarrelling for the present with France's intention to attack as the outcome of these calculations, it may be said here that there was one particular in which the calculation itself was very faulty. Our Ally's General Staff seem to have ascribed to the Germans, in the matter of the utilization of reserve divisions and corps, the intention to use these at the opening in nothing but quite secondary tasks, and to keep them entirely in second line in the early days, this being the method which the French intended to employ with their reserve divisions. This point is brought out clearly in Colonel de Thomasson's *Le Revers de 1914 et ses Causes*, from which we may find it useful to quote later on.

The German Command, on its side, knew that its use of reserve units, which had been, many of them at least, quietly and surreptitiously worked up into something like first-line efficiency, would give them a superiority along the first front which the enemy would not expect. Moreover, Germany's whole plan of the war hung on attacking France brusquely and furiously, and reaping a victory in the west comparable in speed to the campaign that included Gravelotte and Sedan. Germany had to attack and she had to deceive, and the deception was carried out in masterly fashion. She knew French troops would meet hers in Alsace and in annexed Lorraine before they met hers in the north; therefore little appearance was made south of Metz of these "mystery" divisions of reserve. France would then count what she met of army corps in the first collisions, would subtract these from the German "active corps" list, and would find that the northern German invasion could only number so-and-so. In it, as a fact, were the bogus reserve units.

II

During the years immediately before the war we were all trying to arrive at and formulate the real differences between French and German military intentions. However wide the flame of war might spread, these two were bound to be for long the chief protagonists, and on their methods of proceeding the gravest interests depended. Now, people have their theoretical doctrine, their aspirations after perfection of fighting, but

they have also the knowledge that some of the things they would like to do the enemy will not let them do. So they have to fall back on something truly reasonable, and mold their practical doctrine into a shape that will hold what they can hope to do in spite of the enemy. Looking at the matter in a very general way, we always held that, somehow, Germany would be the attacker and France the defender, even with Russia in the lists; and thus the formulation of their two doctrines, built up by us from study of the writings and sayings of many leading German and French soldiers, used inevitably to give a bias towards the certainty of German offensive on the enveloping plan, with a French tendency towards waiting to see what was coming. Under this obsession, which was correct enough, however, though we use the word here, the present writer sketched in *The Foundations of Strategy* (May, 1914) a couple of short statements on German and French doctrine respectively, in something like the following form:

> The "German" doctrine leads to an immediate deployment as for battle, a sweeping advance on a broad front, the deployment in some way sheltered from serious interference by the enemy. This sheltering may be effected on one part of the front by sheer distance, on another by a fortified belt, on another by an adequate covering force. The idea, then, is to roll the great machine onward, to impose one's will on the enemy, and not hesitate even when the hostile dispositions are imperfectly known. The rolling front will not be of even weight at all points, far from it, and the enemy had better look after his flanks; but he cannot reckon it a certainty that the chief German push will, after all, be towards envelopment.
>
> This broad advance has at least the advantage of rendering supply more easy, but its success may be greatly dependent on topography. Physical features, and a hostile fortress or group of works, are apt to bring about gaps or crowding, or at least so to lengthen the line with curves that it becomes weak at places, and it is before these have been readjusted by the capture of the works or in some other way that an active enemy, armed with good intelligence, is likely to present himself in embarrassing fashion.

Now, the German Command did make use, in August, 1914, of all three ways of sheltering their first deployments from interference by the French. In the north they deployed on the distant frontier of Belgium, in the center they were well covered by the very strong *Moselstellung*, the great fortified zone that began north of Thionville and extended southward beyond Metz. South of this again there were unfortified stretches along the frontier itself, held by cordons of troops, who were, however, strongly backed by fortified areas in the rear of them, such as the Mülheim-Strassburg group and the Rhine fortresses of Upper Alsace, Neu-Brisach, Hüningen, etc.

We used to think that this early formation of a great advancing line had its drawbacks, not to say dangers, in that it was rendered difficult for the army to make any considerable change of formation with speed.

> If the commander has made a good forecast of his enemy's dispositions — that is, of what they will be when he reaches the enemy — no change will have to be made. The intention in this system is that, as soon as any part of the great front impinges upon the enemy, everything to right and left shall wheel inwards and envelop him. But if the forecast has been substantially wrong the difficulty of taking up a fresh formation may be very great, and will certainly cause delay. A force deployed finds anything but advance or retreat far from easy.

With the experience of 1914-1918 before our eyes, one would both modify and amplify these words of the spring of 1914. For one thing, the forces were so huge and were extended over so wide a front, that from the very first there was only one flank on which what one might call peaceful envelopment was to be thought of. By this phrase we mean that only the German right could, by superior extension, outflank us; envelopment of both flanks could only be done by the success of a tremendous German push through the gap of Saverne or the *trouée* of Belfort. With Russia to be watched, Germany was not strong enough for such a thing, and she very wisely contented herself with the northern enveloping attempt.

In the spring of 1914 we pursued this subject in the following manner: "It is on the success or non-success of this wheeling-in that everything will depend. We are speaking of very large forces; a German deployment against France may well display 800,000 men from the very start. On a front of eighty miles there would be 10,000 to a mile, or nearly six per yard, a reasonable density for battle." Even if the front had to be 200 miles, as it would have to be, we said, if Belgium were to be violated, it would be easy to have this density on a leading wing; but troublesome delays might occur. "A wing, wheeling inwards, might easily meet with a substantial defensible obstacle such as a well-placed river, and be neutralized for some days by inferior numbers, thus affording the enemy the chance of being the stronger where contact had first taken place. Ground also, formerly looked on as weak, can be rendered astonishingly strong by a few days of skillful entrenching — strong, that is, in a delaying sense."

III

If the telescope of memory, pointing back at a range of more than five years, is accurate, we were saying that in face of a German attack one thing at least is certain in French (and British) opinion — that an attack of this "German" kind, made by a resolute and confident chief leading huge numbers of good, highly-organized and well-equipped troops, can only be sustained by an opponent who is fit and determined to lose no decent opportunity for counter-attack; that the worst thing possible would be to allow the "German" attacker to proceed far with his

inward wheel, because scope for maneuver, that indispensable, would tend to vanish. The enveloping method, aiming at smothering the enemy, whether it be attempted from an initial deployment on a long, continuous front, or from separate points by convergence, using thus several lines of operations, has its dangers, for the belligerent who is practicing it, chiefly if not entirely during the strategic phase. The danger, that is, the specific danger arising from the use of the method, is over when the enemy begins to be really hemmed in, for he is then approaching the evil plight of the invested.

During the years from 1871 to 1914 the French, as has been said, were studying their strategy, and were in particular inclined to found upon Napoleon. But you may found upon Napoleon a whole series of structures of different kinds, just as man has founded upon the Bible a hundred sects. Christiandom, however, was quite right to found on the Bible, just as the French were right to found on Napoleon. The best of the slightly varying edifices that come from the hands of the French military thinkers *seemed* to be founded on a few of Napoleon's maxims of war, but when the war started we found that the agreement with the master had the appearance of lip-service rather than of conviction. Napoleon said—"Concentrate your army *'en arrière et loin de l'ennemi'*—invade across a single frontier on *one* line of operations — turn the enemy's wing without separating the army." The dominating idea was that, with one's offensive troops well in hand and practically in one body, one can ensure full strength for the decisive battle. These are some of Napoleon's *dicta,* produced in concise form for the most part *après coup,* and the student of military history notices that he brought about his completest successes when he operated in accordance with his *dicta.*

His was a case in which boldness and caution preserved an exquisite harmony in their combination. His method tended to the formation of what he called *"bataillon carré,"* that is, he approached the enemy in a mass that had as much depth as breadth. He meant to impose his will upon the enemy, in spite of the sometimes apparent aspect of a profound and dominating prudence in the nature of the formation. He was prudent in the field, but it was a prudence very different from the pusillanimous cautiousness of the commander who is going to wait too long and get himself invested or otherwise immobilized. He knew how the enemy was disposed on a certain date — on the date, suppose, when his own offensive march is beginning; but he recognized that, by the time of collision, the foe might be found to have made considerable changes of position. His boldness consisted in intending from the first to deliver no indecisive, hesitating battle; his prudence in recognizing that the enemy might maneuver so as to prevent the ideal operation, and in planning the formation accordingly.

For the French doctrine, as we find it in some of their authoritative writings just before the war, seems to lack something of that strong objective spirit that put the master at the head of modern captains. Prudence, beautifully refined in words, seems to dominate boldness, instead of being an equal colleague. We are thus given the impression of men writing, who secretly feel that, whatever France may do, she will probably find herself a little inferior in fighting capacity to her old enemy. If we may be allowed to interpolate a comparison of a kind that the Briton will recognize as illuminative — the British Army worried through the retreat from Mons and the battles like those of the First of Ypres, simply because at no time had we the least fear or suspicion that the German was a better man than we.

Von Löbell's report on military affairs in 1908 has the following sentences on the subject of what Germans were supposing the French basic idea to be: "The leading idea is to await the reception of reports of the enemy's action before making final arrangements. Consequently, contrary to German method of procedure, they move on a narrow front with great depth." This formation seems perfectly adapted for adherence to the Napoleonic maxim of operating forward on one line, and it would also, in a country well provided with good roads in all directions, facilitate a deployment to right or left, or to right and left, according as information ran in. It would also be handy for a sudden necessity leading to an oblique or right-angled change of front. From this point of view the French idea has a look of superiority to the German, but the very statement of its facility for a sudden conversion or extension either way almost implies a waiting for the enemy's action. In this lies the danger of all such doctrines. War is a frightfully complicated thing when waged on the great scale. Anything that simplifies the task of the commander in the field is good, within reason, and the German method, if savoring of the headstrong and the arrogant, looks the simpler. We are speaking, of course, of the opening phase of a campaign.

The "French" method is good enough if the commander has the resolution to keep the initiative. Granted this strength of character in a chief, along with suppleness of mind, the "German" method might lead to grave inconveniences, owing to the notorious difficulty of effecting rapidly a fresh grouping in an army already fully deployed.

Such, then, were the estimates that were made up to the summer of 1914 of the ideas and intentions of the military leaders of the two old enemies who fight for the Rhine, and some of the thoughts which these supposed intentions aroused. The conclusion expressed before the war was that the "French" method "requires for success that the chief have something of the ruthless decisiveness of a Napoleon. The 'German' commander has a pre-arranged plan of great simplicity, and is to trust greatly

to numbers, good organization, good army corps leaders, and inherent tactical superiority, this last to be compassed by stiffer discipline and the employment of a more intensive training." The "French" commander is to make his plan when he touches the enemy, and

> is to trust to rapid dislocation from mass in accordance with a swiftly assumed resolution. At that moment when the "German" wheel is imminent, the "French" chief must be well on with his own operation, an operation that must be calculated to compel the enemy to cease wheeling and make in haste fresh dispositions toward a seriously threatened quarter. If a "German" advance can be in this indirect manner checked by a decision-seeking chief using the "French" doctrine, there would be good hopes of victory for the latter.

Hereupon the writer makes such apology as some may think necessary for the crime of quoting from himself, and gives assurance of the kind of repentance that consists in letting bad alone.

IV

Before stating what the French and Germans did in the way of first deployment, it will be interesting to dip into the question of what the French General Staff throught, just before the war broke out, of the probable disposition of the enemy. The corresponding expectation on the part of the enemy is not yet so clearly available, as far as the present writer knows.

Early in 1914 a small book or pamphlet appeared anonymously, entitled *La Concentration allemande d'après un document trouvé en chemin de fer.* It was rumored that this was no treasure trove, but that the booklet was the work of a considerable officer of the French General Staff, and it was in fact recognized by students of recent strategical and tactical ideas that the little book was voicing the expectation of French military circles. In an early part of this article we mentioned Colonel de Thomasson's book, *Le Revers de 1914 et ses Causes.* From that book we take notices of some parts of the pamphlet we are speaking of.

The following list of German effectives is presumed at the outset in the pamphlet: 22 army corps (active or first line), 850,000 men; 20 divisions (reserve), 320,000 men; 5 divisions (landwehr), 80,000 men; 12 divisions (cavalry), 40,000 men; heavy artillery, pioneers, etc., 15,000 men.

This makes a total of 1,305,000 combatants, of whom 905,000 belong to the active Army, to be put into the field at the very outset against France, Belgium, and any little British Army that might materialize. This was to give the Germans a numerical superiority of 300,000 or so.

In December, 1914, French H. Q. published a rather tendencious book, *Quatre Mois de Guerre.* In this the figures of the actual first mobilization against France are: 21 active army corps; 13 reserve army corps

(26 divisions); 10 cavalry divisions; 17 mixed brigades of ersatz, equivalent (say) to 4 army corps. In addition to these, 33 landwehr brigades, equal to 8 army corps; but these were not forward till September.

This represents in actual men only some 100,000 more than the estimate of the pamphlet, putting the Ersatz against the Landwehr; but it is in the use that was going to be made of these troops that the pamphlet, i. e., French military opinion, was going to err. In the first place, a founding was made on statements of men like Von Bernhardi, that there would be an army of shock, composed of active units only, for the opening collision or collisions, and an army of occupation following. This would be composed of the second-class units, would assure communications, take charge of investments, etc. Some think that Bernhardi & Co. were insincere in writing thus, but that is neither here nor there, because in strategy and war preparation generally you can hardly draw the line of unjustifiable falsehood as to what you have and how you mean to use it when the time comes. Germany was to have its shock army as large as 34 army corps, instead of 22 only. The difference represents pretty closely in quantity the amount of force Germany actually used in front line on the left bank of the Meuse and Sambre, which is the same as saying that the German first line was as dense, from Eupen and Stavelot to Strassburg, as the French expected it to be, and that the work north of Eupen was the surprise packet. The French Staff, in fact, having founded on such statements as Bernhardi's, which, indeed, coincided with French intentions in the same connection, came to conclude that Germany *could* not extend so as to be strong in the Brussels country. Is it not possible that this belief on the part of our Ally, becoming known in Berlin, was the very thing that determined the latter to stretch a point and let Reserves and Ersatz units show what they (the best of them) could do?

This matter of density is clearly brought out by Colonel de Thomasson. The French thought the enemy, if he extended to the point of putting strength on the left of the Meuse, would then be necessarily weak in the center, which would afford scope for a piercing operation, which much French authority had a quiet preference for over envelopment. From St. Vith to the Trèves-Sierck sector they expected to find 12 corps in 3 armies, and as a fact the Germans had 3 armies — III, Hausen, 4 corps; IV, Duke of Württemberg, 4 corps; V, Crown Prince; 6 corps; that is, 14 corps. Then, Sierck to Strassburg, the pamphlet says, 3 armies of 3 corps each; the reality was VI Army, Bavarian Crown Prince, and VII, Von Heeringen, having together 8 corps, with some of the Ersatz units superadded.

The Armies I and II, as we know, being Von Kluck's and Von Bülow's are extra to this, and both were brought to the Belgian frontier and deployed north of Stavelot. A great body of German cavalry kept

covering the right of I as it marched past Liège on Brussels, shedding units to deal with Belgians as it progressed, with I also parting with a division or two for the same purpose, and then wheeling to meet the British at Mons and Condé-sur-Escaut. Army II invading on both sides of Malmedy, crosses to the Meuse left bank between Liège and Namur, aiming at the Sambre from Maubeuge to Namur. III, from about St. Vith, strikes the Meuse at Dinant and thereabouts, and incidentally hesitates there, to the detriment of the full German plan. Its commander, Von Hausen, disappears shortly from the public gaze, and his name from the bulletins. Army IV, Württemberg, comes out at the north end of the Duchy of Luxemburg, and has a fairly uneventful journey across the Semoy to the Meuse, Mézières, Sedan, etc.; Crown Prince, V Army, through the middle of the Duchy for Verdun.

The *Moselstellung* comes next, that strong barrier of river and permanent works, covering the Moselle from north of Thionville to south of Metz. This stretch of thirty miles is left to garrison elements for the most part, thus fulfilling the true purpose of fortification, which should be the release of "active" troops for active work. South of this, VI Army and VII face the gap of Nancy, and Von Deimling's detachment, entirely or almost entirely composed of second-line troops, stands on the gap of Belfort. Taking the *Moselstellung* as the geographical center, the German right contains five great armies, the left two and the detachment. The German wheel, pivoting on the north of the *Stellung*, is to be the worker of victory.

On the French side, *Quatre Mois de Guerre* is going to blame individuals for the initial defeat.

V

Now put against these numbers and dispositions the deployment of the French, which was done in five armies. The army corps were of two divisions, except in four cases:

First Army (Dubail), 5 corps; Second Army (de Castelnau), 5 corps; Third Army (Ruffey), 3 corps; Fourth Army (de Langle de Cary), 3 corps; Fifth Army (de Lanrezac), 5 corps.

The order on deployment was from right to left; the first two armies had 21 divisions, the other three 25 divisions.

There were, of course, reserve divisions (51 to 75) that were in the French plan, as remarked above, to have only secondary tasks. These were grouped in twos and threes, and given to the armies, but it was understood they were not to be reckoned as first-line reinforcement except on great emergency. Thus one group was sent to organize the countryside of Hirson, as a *position de repli;* another to mount guard on the Côtes de Meuse; a third to prepare the Nancy Grand Couronné; and so on. But

the French soldiers, officers and men, hated the digging business, and very little was done. Are we not going to stake our campaign on the offensive? they would ask; then what's the use of digging in second and third line?

As for the distribution of these armies at the outset, the arrangement of the railways of France had naturally a say in the matter. Very properly the plan was to cut, as it were, strips from the interior to the frontier, each strip containing a trunk railway or railways, and to make up an army or armies from the various H. Q. of each strip. This was the idea, at least, and it aimed at the avoidance of crossings and mixings-up on the communications; but it could not, of course, be absolutely carried out. Three well-defined strips led to Mézières, Nancy, and Belfort, respectively.

Of these five armies, Dubail's (First) had Epinal as its center. The Second Army (de Castelnau) had the Nancy region, with left nearly to Toul. This army, then had charge of the oft-mentioned gap with five corps, through which; as a fact, an early offensive was planned to be made and was made; and it could have on its right the immediate help of more than two corps of Dubail's. This alone seems to show how largely this proposed offensive bulked in the French plan, there being eight corps available for its prosecution out of the total of twenty-one.

Ruffey's (Third) three corps were to advance in the Verdun region northeasterly, it being assumed that the French fortress region, Verdun to Toul, sufficiently neutralized the *Moselstellung*. Lanrezac (Fifth) had his H. Q. appointed for him at Réthel, his three-division corps (II) and his cavalry division across the Meuse, covering the gap of Marville, and his mass behind the Meuse between Mézières and Verdun, but clear of the latter. General de Langle de Cary (Fourth Army) was to start in second line from Ste. Ménéhould to Commercy, and General Valabrègue had three reserve divisions to the left of de Cary about Vervins. At this stage of planning, the arrival of a British force was reckoned too doubtful, in the matter of time at least, to be taken into account.

The extent, then, of depth in the French initial assembly consists in the placing of the French Army, of seven divisions, in rear of the Third and Fifth, so that the French command was to some degree justifying the expectations that had been formed of its doctrine and intentions. The curious thing is that French writers, like De Thomasson, blame the disposition on the very ground for which it was presumably chosen — that it necessitated a change of disposition as soon as the enemy showed what he was trying for, *whatever that something might be.* But this must have been fully in the mind and intention of the French command, for it was the very basis of their supposed doctrine. The whole theory or doctrine, as opposed to the German, may be wrong; but if it is generally right, then the early dislocation is merely part of the natural execution of the plan. Objectors cannot even get any help from the meaning of the words

underlined above, for no Napoleon or anyone else supposed that you can go into *battle* in *bataillon carré*.

It really looks as if the French command reckoned that, as Germany had Russia to deal with, France was going to be relatively strong enough to attack successfully everywhere at the same time. It was a most rash hope, and the acting upon it was no small part of the cause of our Ally's opening reverses. Some people say, and *Quatre Mois de Guerre* encouraged them to say, that it was the tactical failures alone that brought on the rapid retreats to the very gates of Paris; but is it conceivable that during the retreats the French Armies so improved in tactics that the improvement between August 21 and September 8 enabled them to turn the tables on an enemy who had fairly and squarely beaten them and had been chasing them all the time? It is true that as many as thirty chiefs were deposed in the interval, and this may have produced some betterment, but a great army's tactics are not capable of being lifted from defeat level to victory level in a fortnight by any such readjustment of high commands. If one tried to put in a sentence the causes of the Sambre-Mons defeat and retreat and of the Marne victory and advance, one would say — in both cases the beaten was the surprised, and the surprise was strategical.

The French command appears really to have intended what may almost be called two main offensives, or indeed to be intending a real attack all along the front, with a gap only in face of the *Moselstellung*. Now, when you are going to try to be the attacker, it is quite right to show everywhere the offensive attitude, for reason that anyone can see; but it is not right to partition your strength so that more than one of the attacks is meant to be decisive, unless your total force is hugely greater than the enemy's. To each attack you say — here is the total force available for your affair; do with it as much as ever you can; but you have first allotted to the attack that is to strike the one big blow everything that is not actually required for safety in the other sectors. In our opinion there was something like a whole army wasted in the disposition of the First Army (Dubail). Its VII Corps (three divisions) was to enter Alsace from Belfort, detachments of Alpines were to get on to the Vosges' passes, the rest was to dash, along with de Castelnau (Second Army), at the upper Sarre, the latter's left corps staying back and masking Metz. Here were eight corps at least making an offensive into Lorraine; this force was either too strong or too weak. If the chief work was waiting north of Verdun — and the French Staff certainly seemed to think so — the eight corps kept south of Toul were far too many; if there was real hope of upsetting the whole German plan by a push for the Rhine from the Nancy gap, then eight corps were all too few.

For the employment of Third, Fourth, and Fifth Armies, two cases had to be allowed for, according to whether Belgium was violated or not by the enemy. If not, then neither would French troops enter Belgium; and the Fifth Army would sidestep to the right, to pass between Verdun and the frontier and march towards north of Thionville. The Third Army would advance on the right of the Fifth, which looks like crowding them terribly, and the Fourth would remain in reserve.

Non-violation of Belgium being unlikely, and violation south of the Meuse only being seriously feared, the whole left wing, Third, Fourth, and Fifth, would plunge into Belgian Luxemburg. We say that non-violation was most unlikely, because the German command would know all the time that the extra scope in Belgium was necessary if any enveloping plan was to be counted upon. It was envelopment, and envelopment only, that could give them the rapid victory they aimed at, and when military strategy says, Do it, it is no trifling affair like multiple murder or violation that will stop a Hun. We also say it here for all the world to see that it was the British Army which prevented the envelopment and thus rendered the Marne possible.

The Fifth Army would close on its left, holding then Mézières to Mouzon, to make room for the Fourth. As soon as this was achieved, the plunge forward would be simultaneous, and one cannot help thinking an uncomfortable country was chosen for what was to be decisive fighting by great masses. Descriptions by historians and geographers indicate "close" country; you come across phrases and phases of "*pentes rocailleuses, fonds marécageux,*" "*flancs froids et boisés,*" extraordinary amount of rain and snow for the latitude, great bogs. But the striking point in the French proceedings was that our Ally, who was to be the great maneuverer, had apparently evolved a plan which entailed a mere charging, headlong and everywhere, at the enemy's front.

VI

Now, if this was to be the method for opening the campaign, as soon as it became certain that Germany would violate Belgium, why take up any waiting position, with the Fourth Army in the rear? It is only explainable on the hypothesis that our Ally's command still thought, right on into August, that Belgium might be left untouched by the enemy. If the French attack was to be directed mainly into the two Luxemburgs, an important thing was to get well across the Semoy river before the enemy reached it or began to reach it. People who have seen that countryside speak with respect of the task of forcing the Semoy from the south, and then having to work through the great belt of forest just beyond it. Any well-arranged plan of offense from the south would aim at crossing the Semoy and debouching before the enemy's arrival into the great clearing

that extends from the Meuse at Givet to Beauraing and Rochefort. There was quite unnecessary delay in pushing into Belgium. One French apologist ventures on the plea that their command was waiting for us! This is ridiculous — that a great initial movement, meant to be decisive, should be postponed for a critical week by the wielder of a good million of soldiers, because an Ally's 70,000 or 80,000 had not yet arrived.

Is it, perhaps, just as well that the delay did occur? How would matters have stood, say, on August 20, if the Third, Fourth, and Fifth French Armies had by that date been holding up the German Third and Fourth and Fifth close up to the Duchy and the German frontier? It looks simply as if Von Kluck and Von Bülow would have found their enveloping march rendered much easier and shorter. But one has no reason as yet to believe that the French delayed on account of this danger. If their intention of attack north of Thionville was a whole-hearted affair, they could have been across the Semoy in force by August 12 or 13. By the fifteenth, they began to see the need for extending the Fifth Army towards Namur, and the original offensive plan passed into the category of the might-have-been.

Thereafter a pure strategical encounter on the Meuse and the Sambre was all that remained possible, with a bare chance of our side being still the attacker when the collision came; but by August 20 even this possibility vanished. The German command, in fact, had adhered to its doctrine, had carried out its full plan, and found it successful; the French command does not give the impression of being so sure of its doctrine, and its plan failed. But the competition of the two doctrines is not even yet complete, for Germany was capable of using Belgium in a way forbidden to the Allied sense of right.

As long as there is any uncivilized nation on earth that is armed, we have got to do the same thing or they will come in like barbarians and clean us up. —*James H. Maurer, in Hearings before Senate Committee on Military Affairs.*

The National Guard

MAJOR R. C. GARRETT
Coast Artillery Corps

THE militia of the United States consists of all able-bodied male citizens of the United States and all other able-bodied males who have declared their intention of becoming citizens, more than eighteen and not more than forty-five years of age.

This militia is divided into three parts:

(1) The unorganized militia.
(2) The Naval Militia.
(3) The National Guard.

Of these, we are concerned only with the third component, the National Guard, which consists of all the regularly enlisted militia between the ages of eighteen and forty-five years, organized, uniformed, armed, and equipped as provided by law, and of commissioned officers between the ages of twenty-one and sixty-four years.

The National Guard, in reality, consists of the armed forces of any particular State, the Federal Government having no command over such State force until it is called into service by due process of the law; and even then it has been held that, when so called into the service of the United States, it can only be used to suppress insurrection, repel invasions, and to execute the laws of the Union. The President, therefore, has no authority to call forth the organized militia of the States and to send it into a foreign country with the Regular Army as a part of an Army of Occupation, because the laws of the United States can only be executed on its soil and there can be no invasion or insurrection beyond these limits. However, the Attorney General has also held that when the National Guard is called forth on a proper occasion there is nothing to prevent its being sent outside the limits of its own State.

The National Defense Act provides as follows:

> When Congress shall have authorized the use of the armed forces of the United States for any purpose requiring the use of troops in excess of those of the Regular Army, the President may, under such regulations, including such physical examination as he may prescribe, *draft* into the Military Service of the United States, to serve therein for the period of the war or the emergency, any or all members of the National Guard and of the National Guard Reserve. All persons so drafted shall, from the date of their draft, stand discharged from the militia, and shall be subject to such laws and regulations for the government of the Army of the United States as may apply to the members of the Army whose permanent retention in the military service is not contemplated by law.

When drafted the National Guard is a part of the Army of the United States and subject to the same service as may be required of other components of the Army, and it is only after actually being drafted that the National Guard becomes a part of the Army. Officers of National Guard organizations, drafted into the service under this Act, are appointed in the Officers' Reserve Corps and commissioned in the Army of the United States, provided they do not already hold such commissions. In order to cover this draft law, each officer and enlisted man is required to take a dual oath to the United States and to the State.

The difference between "call" and "draft" follows. "Call into the Federal Service" means that the National Guard of any State is brought into the Federal Service for a temporary period for duty within the territorial limits of the United States without losing its State identity. On the other hand, "draft into the service" means that the National Guard becomes a component part of the Army, losing all state rights.

Due to the provision in the National Defense Act whereby National Guard Officers may not be commissioned in the Officers' Reserve Corps at a higher rank than they hold in the National Guard, a great deal of dissatisfaction has arisen, for, promotion in the Reserve Corps being faster than in the Guard, the result is that many Reserve officers junior during the World War are now senior in rank.

The strength of the National Guard is based on a study made by the General Staff and, as a result, the allotment per state is eight hundred enlisted men per Senator and Representative in Congress. A recommendation made by the Secretary of War provided that, until July 1, 1926, the development of the National Guard should be such that by that date a minimum strength of two hundred and fifty thousand enlisted men should be reached. But, in June, 1924, it became evident that the National Guard had overcome many of its problems, and recruiting had become so good that the strength rapidly approached a point beyond which appropriations would not be sufficient. Instructions were therefore sent out to the various states by the Militia Bureau limiting the strength of the National Guard.

The training of the National Guard presents the most difficult and complex phase of the development of this second component of the Army. The mobilization plans of the War Department place the National Guard in the first line in the event of an emergency, to assist the Regular Army in the defense of the country until additional necessary man power can be mobilized, equipped, and trained and the offensive undertaken. From a superficial glance this would seem like placing dependence on the proverbial broken reed.

For eleven and one-half months of every year the National Guard has not less than one drill per week, each of one and one-half hours. This

gives a minimum of seventy-five hours of scattered instruction in the armory where many phases of training can not be undertaken. The other two weeks of the year are devoted to field training where intensive instruction is given in camp routine, sanitation, combat principles, and target practice with the weapon with which the particular organization is armed.

Of these seventy-five hours of armory training, some hours are taken up by inspections, parades, reviews, physical drill, etc., which reduces the actual hours of military instruction of a real benefit to about fifty hours. Therefore it can be seen that the actual training of the Guard is small. Just imagine what a regular army unit would be if it only had fifty hours of training per year! However, where schedules are carefully planned and efficiently conducted and where the objectives are not too far advanced, it is surprising what can be accomplished in a short time by energetic and intelligent effort.

As before mentioned, the mission of the National Guard in time of peace is to provide a means by which the citizen may fit himself for military service without leaving his vocation, and to provide an adequate and effective force, available in minor emergencies for employment by the State and the United States, and in the case of war to continue to function as first line troops from the call or draft.

The ultimate objective of training of the National Guard to fulfill this mission is the combat efficiency of the highest tactical unit. The intermediate objective, which must never be exceeded until each unit has demonstrated its ability by thorough tactical inspections by higher commanders and by instructors, is the tactical efficiency of battery, battalion, and regiment. It is with this intermediate objective that instructors are primarily concerned.

At the present time the Federal Government appropriates approximately ten million dollars per year for the maintenance of the National Guard and has detailed from the Regular Army four hundred and seventy-four officers as instructors and five hundred and ninety-two sergeants as assistants. In return for this assistance, it demands that the Guard shall comply with certain standards.

One of the requirements concerns the professional fitness of officers of the National Guard. No officer can be commissioned in a combat branch unless he has had previous military service in the Regular Army, the National Guard, or the Navy, and, in addition, he is required to pass a most rigid mental examination for both appointment and promotion. Further, the State of New York will refuse a commission to anyone who is not a veteran of the World War if he is within the age limit of the war.

How are these officers enabled to comply with such high standards? First, by weekly officers' schools by the regimental instructor, who lays out his own course; Second, by correspondence schools, which are of

particular value when the instructor is unable to reach all his officers personally every week; Third, by means of the various service schools which National Guard officers are permitted to attend. The weekly schools lasting from two to four hours have proven to be the most efficient.

Such are the various means provided for the training of officers independently of their units. The instructor who conducts such training must work with the idea of teaching them to impart this knowledge to the enlisted men of their units, for it is by this means only that efficient instruction is given throughout the entire organization.

For a great many years prior to the World War it was the custom that the instructor should actually perform many duties that should have been performed by the National Guard personnel, leaving for them only the actual thrill of pulling the lanyard. These conditions are now changed, the idea being that the Guard should assume its own responsibilities and do all of its own work; and it can be seen that this is the only method whereby both interest and efficiency can be obtained.

The scheme of instruction used with the New York National Guard is that no instructor other than the one regularly detailed, or who has previously been detailed, would be utilized during the Summer Training Camp. By means of a daily conference with the regimental commander, his staff, and the battalion commanders the schedule for the following day was decided and was then published in orders. The senior instructor and his assistants usually sat in as liaison officers in order to coordinate the activities of the National Guard with the post and acted only in an advisory capacity. During the target practice the instructors assumed the duties of safety officers, as required by War Department orders, and only interferred with the conduct of target practice where it was absolutely necessary.

This plan, as it worked out, was an excellent one and put the Guard absolutely on its own. After all, what is the mission of the instructor? It is to train and develop a unit which he could be glad to command and, after a short period of intensive training, lead into action. Keep this well in mind and, should the occasion arise whereby it is your turn to guide the National Guard, think well before you make the choice that will determine your training methods.

All officers of the Army should be generally familiar with the policy, regulation, and mission of the National Guard. Most certainly, any officer detailed with it should go into the matter thoroughly, especially those subjects that have a bearing on his future duties. It would be inexcusable for an officer to report for duty not knowing how National Guard officers are appointed, promoted, and paid. These people assume, and rightly so, that the Regular Army is familiar with and in sympathy with their

efforts, and it comes as a shock to find ignorance in the very fundamentals that Army officers are supposed to know.

Remember this when reporting as an instructor of the National Guard —the great majority of its officers have excellent records made during the World War and long service and experience with the Guard; their records in most cases are as good if not better than your own; the majority of them are successful business men, as efficient in their line as you are in yours. Among the personnel you will find all classes, rich and poor, but in every case a desire on their part to learn and to be friendly.

In my opinion, before being detailed with them, an officer should have qualifications in the order of their importance as follows:

(1) Desire for the detail,
(2) Agreeable personality,
(3) Ability to instruct.

An officer of the Coast Artillery expresses the matter well when he gives as a motto for instructors: "Learn your job—Do your stuff—Act human."

After the conclusion of the war of 1870, Germany, guided by the iron will of Bismarck, divulged to Switzerland that the mailed fist had an itching palm for Swiss territory. Immediately an army of a hundred thousand Swiss mobilized on the frontier. They were the best-armed, the best-trained, and altogether the most efficient soldiers in Europe. * * * Bismarck concluded that the game was not worth the candle. If Switzerland had not been armed to the teeth and ready, that country today would be a part of Germany. —*Hudson Maxim.*

Instructors With the National Guard

MAJOR GEORGE W. EASTERDAY
Coast Artillery Corps

IT has been said by one of the world's greatest epigrammatists that "It is at all times dangerous to give advice, but to give good advice is absolutely fatal." Notwithstanding this rather ironic warning I shall endeavor briefly to point out some of the principal duties of an instructor with the National Guard and indicate a few ways and means by which he may overcome some of the many difficulties and problems that will confront him. By this temerity on my part do not get the idea that I presume to be the proud possessor of an "approved solution." Far from it! But, from observation of the successful efforts of others and by experience, which is the name every one gives to his mistakes, I have deduced certain ideas and principles which I believe to be fundamentally sound and which I hope may prove to be of some small assistance to the neophyte in this important work.

It must be assumed that, before embarking upon his several duties, the instructor is thoroughly conversant with the psychology of the National Guard, the underlying principles and motives that actuate it, and the nature of the personnel of which it is composed. The limited space at my disposal does not permit of an elaboration on these matters, although they constitute a most important aspect of his work. Let us then pass at once to what I have termed the basis of contact of an instructor with the National Guard. This basis of contact is determined by his status with respect to the Corps Area Commander, his status with respect to the community in which he lives, and his status in the organization to which he is assigned.

An instructor is detailed for duty with a particular State by the War Department, but he is assigned to his specific duties by the Corps Area Commander, under whose direct command he has been placed. He may be assigned as an assistant to another instructor senior to himself or he may be placed in charge of one or more junior instructors and several sergeant-instructors. In either case the Corps Area Commander will hold him accountable for maximum service in aiding the State authorities to carry out the policies and plans of the War Department for the organization, equipment, supply, administration, and training of the National Guard.

The official channels of communication of an instructor are through the Corps Area Commander, unless otherwise directed by the latter, but

in no case should an instructor communicate directly with the Militia Bureau or other agencies of the War Department.

As to his status in the community, his should be the natural human attitude of any other citizen of the highest type in the community, with full tolerance and interest in local matters, without at any time being a partisan. He should establish the best social contacts and join local clubs, provided he can do so and still live within his income. Generally speaking, the smaller the community the larger his relative sphere of influence and activity, and the more closely will he be watched.

We now come to the organization itself. It is here we find the close personal contact that exists between instructor and pupil, and his true status is revealed in all its details. In the first place, an instructor, unless commissioned in the National Guard, is not under the command of the National Guard authorities nor subject to their orders, nor can he, on the other hand, issue any orders to National Guard personnel. He, therefore, has no function of command or control. Where an instructor has accepted a commission in the National Guard, he places himself under the command of the State authorities by virtue of such commission only, and this relationship is entirely apart from his Federal status as instructor, which he still retains.

An instructor is merely a form of Federal aid, authorized by the National Defense Act. His primary duty is to serve in an advisory capacity only. He should give the fullest aid and assistance possible in the theoretical and practical instruction and training of the organization to which assigned. He should personally impart instruction whenever it is considered necessary or advisable, even to the point of demonstration in acting as a drillmaster, but always in such cases first obtaining permission from the immediate commander concerned. Ordinarily, he should refrain from the actual instruction of the organization or of its individual members, remembering always that upon the commander devolves the full responsibility and functions of command and he should be encouraged to the utmost to exercise such functions. It is, therefore, evident that one of the outstanding duties of an instructor is to assist in the development of teaching ability and qualities of leadership in the National Guard officers and non-commissioned officers and, at the same time, to give them the advantage of his technical knowledge and training. La Rue in *Science and Art of Teaching* says, "The greatest thing you will ever teach your pupils is that they can get along without you." I know of no place where this is more true or apt than in the training of the National Guard.

This task, however, is no easy one. It calls for the exercise of discretion, tact, and that quality of leadership which, without power to command or punish, is yet able to inspire willing following and an ambition to meet his standards. His knowledge, energy, enthusiasm, and

genuine spirit of cordial helpfulness must form his chief reliance. An instructor having no authority to enforce the laws can only point out the laws and regulations, advise how they are to be followed, and, from his experience, indicate the best means to attain military efficiency.

Above all things an instructor should realize that he can not get results by "hard-boiled" tactics. The limit to which an instructor can go in his criticisms can not be pointed out definitely, for it varies with the man's personality, but it should be remembered that National Guardsmen, like everyone else, appreciate being approached in a friendly manner. The instructor can rest assured that the best line for him to follow is to make friends with the men associated with him and to inspire their confidence by demonstrating his knowledge of his profession and his understanding of their viewpoint toward the military service.

As to the instructor's professional qualifications, it is essential that he be fully informed and conversant with the subjects he is required to teach. There is no substitute for thorough accurate knowledge on his part. It should be of such scope that no attempt at subterfuge should be necessary; that is to say, he should never attempt to bluff. A continued use of such tactics would soon lose for him the respect and confidence so essential to his success.

An instructor will find many problems confronting him in his work, some of which he may be able to anticipate, others appearing without warning. The number and variety of these problems are largely influenced by the State and locality in which he is serving. Communities composed largely of the organized labor element are often opposed to State forces on the grounds that they are potential strike breakers. Socialists and pacifists are also hostile to military forces generally, for other well known reasons. In such communities, whatever may be the basis of the hostility, an instructor's work is most difficult and calls for more than the usual amount of tact and diplomacy.

The distances separating organizations also present a problem. Where an organization the size of a regiment or a battalion is located in one armory personal contact, with its subsequent advantages, is easily obtained with the entire personnel. However, where the units of a command are widely scattered, that is, where only one company is located in a community, the difficulties of instruction are increased. The only satisfactory solution makes it incumbent upon the instructor to travel from one armory to another as often as the funds allotted him for the purpose will allow. And right here he is confronted with one of his greatest problems, the regrettable lack of Federal and State funds to pay for such visits, and he is forced to fall back upon correspondence methods. Instruction by correspondence is the poorest method of training the National Guard and should be avoided whenever it is possible to do so.

Some instructors find themselves assigned to new and untried units. Here the instructor is at a decided disadvantage compared to one assigned to an organization with war records, precedents, and honored traditions. In such cases, in addition to the training, his chief concern should be the building up of *esprit* and morale, and it is well within the scope of the instructor to exercise a decided influence in these matters.

Often an instructor is confronted with a lack of space for office work, due to a small and congested armory. The State is supposed to provide him with an office, but where such is not the case he should apply to the militia Bureau for authority to rent an office at Federal expense. If unauthorized to do so for lack of funds, he must resort to his home for his office, obtain a room in the Federal Post Office building, or adopt some other expedient to meet the situation.

Problems incidental to the training proper—for instance, the method of handling the sergeant-instructors—require considerable discussion and cannot be taken up at this time.

It is imperative at the start that an instructor thoroughly familiarize himself with all of the laws and regulations relating to the National Guard and to his duties as instructor. He will find his "Bible" in such matters to be the National Guard Regulations, and his duties are enumerated therein at detail. Other printed or written matter controlling an instructor's efforts are the Militia Bureau Circulars and mimeographs, the National Defense Act, Army Regulations, and written matter from the Corps Area Commander.

In closing, I give a few "Don'ts" for the benefit of the new instructor.

Don't engage in heated arguments or disputes over interpretations of the regulations, the relative value of the different arms of the service, or other stock sources of quibbling. Remain on the firm ground of a dignified and friendly statement of the regulations or law as published, always with the maintenance of good humor.

Don't make invidious comparisons between the National Guard or other components of the Army of the United States.

Don't attempt to bring about drastic changes in National Guard administration or methods at the start. Take time to study the problem from all sides and wait until a thorough acquaintance has been made with the local situation before acting.

Don't correct officers for improper commands before their organizations. Advise prompt obedience to military superiors at all times, even when orders issued are due to a misunderstanding or ignorance of the regulations. In such cases the officer who gives the improper command or order should be induced privately to make the proper corrections himself.

Don't give too much of your time to one organization at the expense of another. This is a common error. An instructor should be impartial in giving his services to the different localities of the State, without regard to his place of residence.

Above all, don't become involved in local politics. This applies to politics both in a party sense as well as to disputes or internal dissentions within the organization, or between members of the organization and the State authorities. Taking sides in any cliques or factions, or becoming involved in any disputes or arguments between individuals or group of individuals, is fatal and will ultimately impair the efficiency and value of an instructor. Unfortunately, several instructors have fallen into this fatal error and always with disastrous results to themselves, usually resulting in their relief from duty. The same caution should be applied to matters of State legislation. If an instructor takes part in legislative activities it should only be when he is called upon for professional advice and then he should act in the capacity of an expert witness free from political bias. He should never engage in the practice of lobbying.

In contemplating the many pitfalls which may beset him and the many difficulties to be overcome, an instructor should remember that the word "discouragement" is but the unfortunate and unnecessary phrasing of an idea, and not the name of a fact. In brief, it may be said that the best instructor is the one who indicates a desire to be of service to the organization with which he is on duty and has the ability to render this service while retaining the friendship of those with whom he is associated. The best test as to whether an instructor is fully successful is found in the answer to the question as to whether the organization with which he is on duty would welcome him as a member.

War is not a cause, but an effect. Its likelihood can only be lessened when its causes are lessened. Adequate preparation against those causes is not itself a cause, but a prevention; not a provocation, but a restraint.—*Rev. John W. Day, D.D.*

Railway Track Turn-Outs, Spurs and Curves*

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WHILE the laying out and construction of railroad turn-outs and spur tracks is normally a function of the Corps of Engineers, in some cases, particularly when short firing spurs are required, the railway artillery will find it necessary to lay out and construct their own tracks. It is therefore essential that railway artillery personnel have some knowledge of the theory and practice of such work and understand the governing principles. So, it is my purpose here to discuss in a general way some of the principles and methods of railroad location and construction, and to explain the fundamental mathematics of laying out track turn-outs and curves.

Location.—Prior to construction it is necessary to choose, and define upon the ground, a center line upon which a railroad bed is to be constructed and tracks laid thereon. This center line, consisting of a series of alternate straight lines and curves, is called the "location," and must satisfy certain operating requirements of alinement and grade. In choosing it and defining it upon the ground, the locating engineer must not only have these requirements in mind but must so place the line that a railroad may be constructed on it at a cost, both in time and money, which is the minimum consistent with the purpose which the railroad is to serve. The placing of the location is, therefore, of much importance.

Maximum Grades and Curves.—The straight lines of the location are called "tangents" because they are common tangents to the curves which they connect; while the curves, which are arcs of circles or combinations of such arcs, are classified as simple, compound, and reverse. To satisfy operating requirements it is requisite to establish the maximum grade which any portion of tangent track may have and the minimum radius of arc which may be used. In fixing the maximum grade, the maximum loads to be hauled, the traction (force which a locomotive can exert to haul a train) of the engines to be used, and speed of operation are the governing considerations. The minimum radius of arc, or maximum degree of curve, depends upon the maximum rigid wheel base of the operating equipment to be used.

In the case of permanent railroads for commercial, or general, operation, the maximum grade and curvature is usually established, not as the maximum possible to operation, but as the maximum which has been found best suited to the character of the traffic expected. However, when

* Lecture delivered at Unit Camp, Fort Andrews, Mass.

time of construction is a vital element — especially in the case of access tracks to be used only to move guns to their firing positions, to bring up ammunition cars as needed, and for final withdrawal — the maximum grade and curvature over which it is possible to operate at any speed might well be used if the time required to prepare the track might be shortened thereby. But whatever maximum grade may be determined upon it must not be used on a curve, since they offer the same resistence to operation as does a grade. The extent of this curvature resistance is usually assumed as about four hundredths of one per cent (0.04%) per degree of curve. In other words, assuming the maximum allowable grade to be 5%, the maximum actual grade allowable on a ten-degree curve would be 4.6%.

Other considerations.—When the maximum allowable grade and curvature have been decided, the governing elements in establishing the location on the ground are: (1) the points as terminals to be served, (2) the character of traffic expected, and (3) the topography and character of the intervening terrain.

Assume the case of a spur track to a firing position. The terminals are the gun emplacement and the point of connection with the approach track. The first of these, having been chosen to serve artillery requirements, is definitely fixed and must be approached from the rear with sufficient straight, level trackage amply to accommodate the gun car and one ammunition car. Consequently there is at this terminal, within the limits of level trackage requirements, no choice of route or location. At the other terminal the locating engineer may choose that point for connection with existing or extemporized track which will best enable him to take advantage of the terrain features. It will, therefore, usually be found advisable to protect the location from the firing position to the existing track.

The character of contemplated traffic determines the degree of refinement which must be used in establishing the location. An access track over which it is possible to move the gun and ammunition cars, at any speed, and which can be constructed in time to get the guns into position when needed, will serve the purpose, whereas a better track which cannot be constructed in the time available will not serve at all. Consequently, when time is a vital element and the character of traffic is definitely known, the location need, and should, be such only as is necessary to produce a line over which it is possible to operate. Hence, while maximum grade and curvature must not be exceeded, no time should be wasted in laying the tangents down perfectly straight or the curves to a line arc. This condition undoubtedly would obtain in many cases in railway artillery practice.

The topography and character of ground traversed by a location very largely determines the amount of work, and consequently time, necessary for construction. It is therefore particularly essential that the location be so placed that, while complying with the requirements, every advantage shall be taken of topographic features and characterictics to avoid construction difficulties. For this reason a good location engineer must be familiar not only with operating requirements and the mathematical problems involved in establishing a location, but he must be sufficiently familiar with construction work to estimate with some accuracy the comparative time required for construction on alternate lines open to his choice, which would enable him properly to decide the point of turn-out in the case of an access track. In general, clearing, grubbing, and earthwork require much more time than does track laying, consequently the location, when operating economy is not a consideration, may properly be increased if heavily wooded and difficult topography can be avoided thereby and the natural surface of the ground can be more nearly followed.

General Procedure.—In establishing a location the course of procedure in civil practice, in the absence of good topographic maps, is by three separate steps: (1) the reconnaissance, (2) the preliminary survey, and (3) the final location work.

The reconnaissance is a hasty personal examination of the ground for the purpose of observing its prominent features and general topography; the preliminary survey is an instrumental examination of the ground along traverse lines laid down on favorable ground in the general direction of the final route, the angle points being staked, and a level party closely following keeps a check on the survey party in respect to grades and construction requirements and takes cross-sections; and the final location work consists of plotting the preliminary survey, varying and adjusting it to meet the exact requirements, and staking out this adjusted location on the ground and otherwise marking the details for construction and grade work.

There are many details to this process, but its outline only is necessary here, with the added observation that in locating an approach track of any great extent it will be found practicable more or less to follow a similar procedure in military practice.

Construction.—The road bed is the track support and consists of the foundation, or road bed to subgrade, and the ballast. By subgrade we mean the grade upon which the ballast rests. The ballast is the material which holds the track in surface and in line. The purpose of the ballast requires that it should be a material from which water speedily drains and which can be well tamped around and under the ties to hold the track in good line and surface. For temporary tracks, unless the ground is

very unfavorable, it is not necessary to use a separate ballast, but even then the earth directly under the ties and filling the space between them is called ballast and is commonly referred to as "mud ballast." In such cases the top of the road bed cross section should be so shaped, or crowned, that it will tend to shed the rain-fall.

The cross section of the road bed must be decided upon before the level party starts to mark the outside limits of cuts and fills. For permanent railroads there are standard widths of road-bed surface commonly used. For temporary tracks, however, these widths may be cut down in fills to that which will result in an embankment that will safely carry the traffic contemplated, and in cuts to a width that will give necessary clearance for operating equipment and permit side drains to be made.

As a rule the ties are laid — spaced approximately two feet on centers — on the surface of the ground, and the rails are fastened to them. If ballast other than mud ballast is to be used, this makes it possible to bring it up by train. The standard rail lengths are thirty feet and they are joined together by angle bars. The size of rail is designated in terms of pounds per yard, and for standard gauge track it varies from 60 to 110 pounds. Rail joints are usually placed opposite each other and the rails are secured to the tie by a spike staggered on either side. As a guide in estimating work, it may be said that a crew of a hundred men should lay, line and surface approximately a mile of track in a 10-hour day when properly directed.

Railway Curves.—The *rate of curvature* of a circular arc is a function of its radius. In railroad work this rate is expressed in terms of the angle subtended at the center by a chord 100 feet in length, and a curve is referred to as a one-degree, two-degree, etc., curve according to the number of degrees of arc subtended by the chord (see Figure 1, Plate I). The degree is calculated by the formula: $\sin \frac{D}{2} = \frac{50}{R}$.

A *simple curve* is one which has a constant radius throughout its entire length (see Figure 2, Plate I). With reference to the direction in which the line is being projected, the point where the tangent ends and the curve begins is called the PC — point of curve — and the point where the curve ends and a tangent begins is called the PT — point of tangent. The elements of the curve are: the central angle, I, which is equal to the angle formed by the intersection of the tangents which the curve connects; the degree, D; and the length, L. L is a function of D and I, and is determined by the formula $L = 100 \frac{I}{D}$. This formula is based on an assumption that a chord 100 feet in length subtends an arc of like length, and is correct within reasonable limits for curves up to D = 9 degrees. For 9-degree curves and over, however, L should be determined by the formula $L = 2 \pi R \frac{I}{360^\circ}$. The point at which the tangents produced will

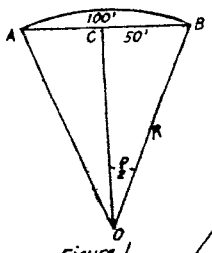


Figure 1

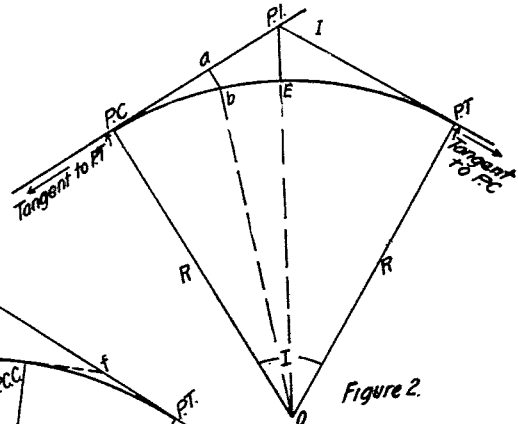


Figure 2.

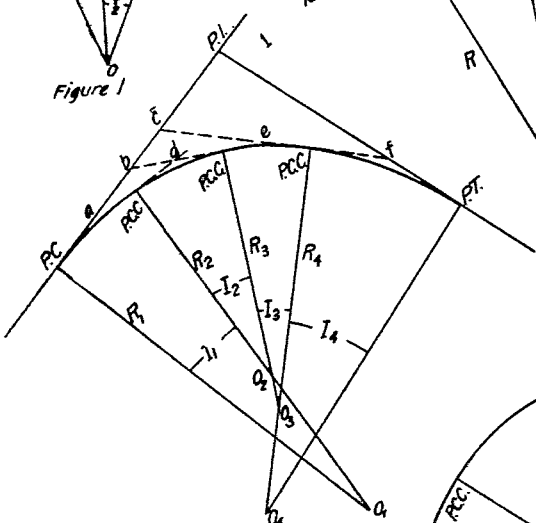


Figure 3.

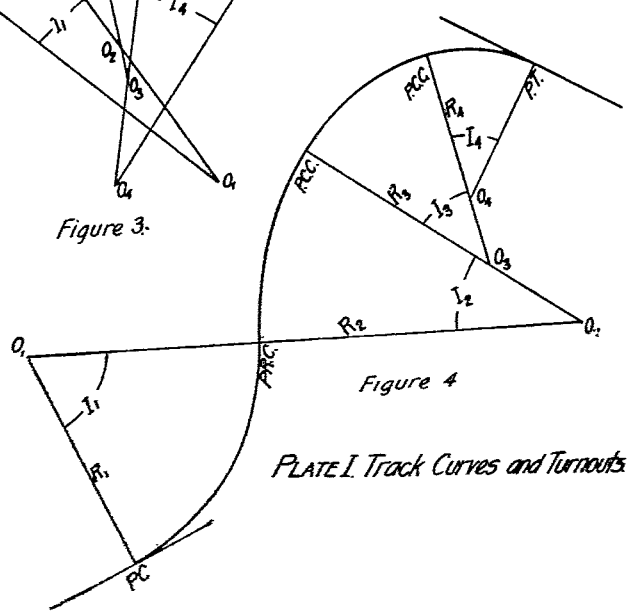


Figure 4

PLATE I. Track Curves and Turnouts

intersect is called the PI — point of intersection; the distances from PC and PT to the PI are the tangent distances, or semi-tangents; the distance from the PI to the middle point on the curve is called the external distance, or external; and the right-angular distance from any point on a semi-tangent to a point on the curve is called a tangent offset. The external, E, is equal to R exsec $\frac{I}{2}$, and the tangent distance, T, is equal to R tan $\frac{I}{2}$.

Assume, as is frequently the case, that the topography is such that the curve location is controlled by a small area located about opposite the PI, and that it is desired to determine the degree and position of the curve to be used. The distance from the PI to a chosen point which clears the difficult topography is measured and becomes the external distance, E, of the curve to be used. The central angle, I, has been previously determined and the radius of the curve may be determined by the formulae given above. The PC and PT may then be established on the ground by laying off the tangent distances from the PI. The curve may then be run out with a transit by the method of deflection which is based on the theory that the angle formed by a tangent and chord to a curve is equal to one-half the angle which the arc subtends at its center.

The foregoing outlines the most usual and least difficult method of laying out curves. It is not, however, infrequently the case that the PI is accessible, or that there is more than one topographical feature which influences the choice of curve to be used. Such situations require the solution of special problems.

A *compound curve* is a series of simple curves of different radii, curving in the same direction. As in a simple curve the beginning and ending of the compound curve are called respectively the PC and PT. The points at which the arcs of different radii adjoin, i. e., where the points of radius changes, are called PCC's — points of compound curve. Figure 3, Plate I, illustrates a typical four-centered, or four-branch, compound curve and its elements.

A *reverse curve* is a series of simple or compound curves turning in opposite directions. The point at which the direction of curvature changes is called the PRC — point of reverse curve. Figure 4, Plate I, illustrates a reverse curve, one branch of which is simple and the other compound.

In track terminology, *super-elevation* means the amount the outer rail of a curve is raised above the lower rail to counteract the centrifugal force of a moving train. For slow speed of operation tracks may be laid on a true reverse curve, but for high speed of operation, where the outer rails on curves are super-elevated, a tangent of not less than the length of the longest car to be used should be inserted to enable the equipment to right itself in passing from the super-elevation on one rail to that on the opposite rail.

Turn-outs.—Train movements to and from side and spur tracks are made by means of a turn-out, which consists of a switch and frog and curve lead rail. The switch is the device by which the move is directed, and the frog is the device by which the flanges of the wheels are enabled to cross the main line rail.

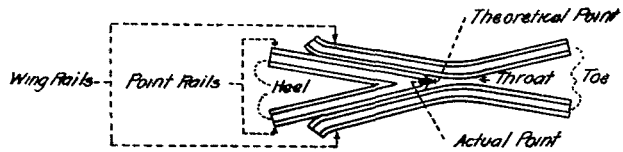


FIGURE 1.

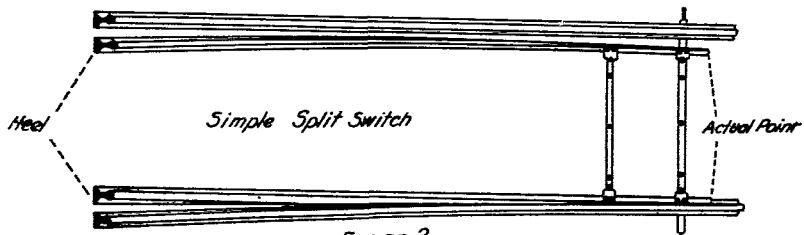


FIGURE 2

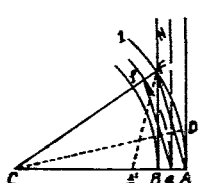


FIGURE 3.

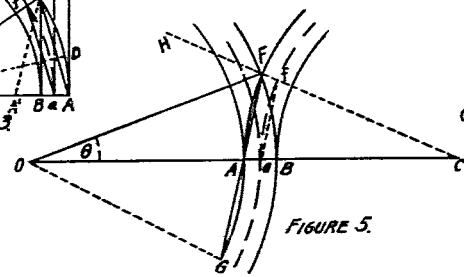


FIGURE 5.

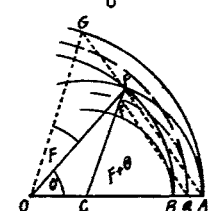


FIGURE 4.

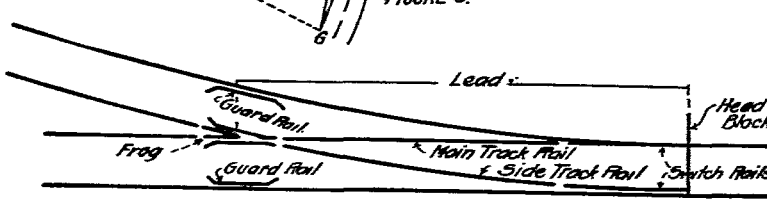


FIGURE 6-Arrangement of Turnout

PLATE II TRACK CURVES AND TURNOUTS.

There are various types of switches, but the simple split switch is most commonly used. It consists of two short wedge-point rails, one pointed to the outside rail of the turn-out track and one to the opposite main line rail. These switch rails are fastened together by tie rods, and connected by a switch rod with a "switch stand," the device by which they are thrown and held in position to direct the movement desired.

The frog is a fabricated device, rigidly assembled, which provides channels through which wheel flanges pass in crossing the main line and sidetrack rails in which it is installed. It consists of two point rails and two wing rails. Figure 1, Plate II, illustrates it in plan and shows the nomenclature of its parts. Frogs which are commonly used and held in stock are usually referred to by number, the number being the ratio of the distance from the theoretical point to the heel, measured on a line bisecting the frog angle, and the spread or width of the heel. Frogs which are not standard are designated by the angle which their point rails form, and are used only in special cases as needed to fulfill requirements which cannot be satisfied by the characteristics of standard frogs.

The lead rail is a standard cross section rail curved to a circular arc, which connects the heel of the outer switch rail with the sidetrack wing rail of the frog. The radius and length of the rail is a function of the frog angle and the length of the lead; that is, the distance from the point of switch to the point of frog.

Figures 3, 4, and 5, Plate II, illustrate, by center line, turn-outs from standard track. The calculations involved will not be discussed.

Organization of Work.—Regulations give the personnel for a track-laying party and the equipment appropriate and necessary for same. To this I will add that the party organization for location of a short track may well be:

1 Officer—locating engineer
1 N. C. O.—instrument man
2 Rod men
2 Chain men
3 Axe men

These should be provided with the following equipment:

1 Transit, with well-adjusted level
1 Clinometer
2 Sighting rods
1 Level rod
2 100-foot steel tapes
2 Axes
Stakes and marking crayon

Conclusion.—The foregoing is but a sketchy outline of the elemental principles of railway location and construction. It is not possible to cover the subject in detail in a limited space, nor is it possible to discuss the special problem of curves and earthwork which may arise. I have only attempted to give a general idea of the whole subject. It is pertinent to say, however, in connection with track work that there are several rule-of-thumb methods with which all good section foremen are familiar, by which frogs and switches may be installed and short spurs laid and lined with considerably more speed than by the location procedure outlined above, and it would seem that a competent foreman would be a most valuable item in the personnel makeup of every battalion of railway artillery.

EDITORIALS

Courtesy in The Army

ONCE upon a time — as all good stories begin — the Army, from top to bottom, was noted for its courtliness. Its politeness was ceremonial. It partook of the stateliness which accorded with the usages then in vogue. In the course of time courtliness, as such, disappeared, but courtesy remained. There were two separate and distinct kinds of courtesy — fundamentally different but equally pronounced. In the first place, there was that courtesy which existed between the several different grades in the hierarchy of the military service, the deference expected from a military junior to a military senior — a deference which was paralleled in civil life by the courtesy of youth to its elders. In the second place, there was the courtesy which existed between military personnel of equal or approximately equal rank — a courtesy of social equals. This latter was no less expected and demanded than the former. It appeared in the daily contacts, and also in the correspondence wherein, for a long time, it partook somewhat of the courtliness of earlier days. These courtesies — between military unequals and between military equals — are no longer so apparent. Their passing was, perhaps, unavoidable, but none the less to be regretted.

More and more America tends toward abruptness in business and in social relations. Modern ideas of efficiency demand that time be not wasted, and courtesy, being a consumer of time, must needs give way to efficiency. With our exaggerated ideas of the value of our time we cannot stop to exchange the usual amenities of life, and so courtesy becomes a thing of the past. This does not mean that Americans are intentionally discourteous, but there is more and more apparant a lack of courtesy in their relations with each other which often borders on the discourteous. It would seem well, then, to stop and inquire where we are bound and whether or not we desire to continue on the same path.

In the Army it is quite common these days to see officers of the same or approximately the same rank meet with little or no greeting beyond a half-hearted, unmilitary salute or a wave of the hand. It is also quite common to hear privates and corporals address a sergeant as "Sarge" or to call him by a nickname. Not long ago a Major in his own office remained seated while conversing with a General Officer who was standing.

Recently an enlisted man inquired of his company commander: "Say, Captain, do you want your horse brought up now?" Even more recently a noncommissioned staff officer addressed a field officer: "Where's that bunch of papers you had?" How many enlisted men are there who know any other and more formal way of phrasing these questions? How many company officers are there who will see anything wrong with them? Small points, these? Perhaps, but are they not significant? Is such abruptness and informality necessary in the Army? Is it good for discipline, for morale, for the many small things which make the difference between a good army and an excellent one? Would we not do better to keep in mind and to act upon the idea which Emerson conveys when he says, "Life is not so short but that there is always time enough for courtesy"?

Be Hammer—Not Anvil

Longfellow once wrote that "In this world a man must either be anvil or hammer." The cynic might, perhaps, translate this as "Knock or be knocked," but, since Longfellow never for a moment had so poor an opinion of mankind, we read into his line the meaning: "In the accomplishment of all things in this world a man must be either an active or a passive agent." If this interpretation be correct, it becomes apparent that Longfellow considered that there was no neutral condition—that the influence of all men appears in the deeds of one and that of one man is felt in the deeds of all.

In the terms of the smithy there are, of course, two other factors that enter into creation—the material to be worked and the heat that makes the material workable. In the larger affairs of humanity it is mankind that is being shaped anew in the smithy of life and man himself creates the conditions—provides the heat—whereby the material is made workable. But in the end, be the affairs large or small, we get back to the original division—each man, in one capacity or the other, must play his part and must have an influence on the ultimate result.

In business, in politics, in sociology, in whatever field we venture, the subdivision holds—man must be of the hammer or of the anvil. On the one hand is an active element—the hammer—seeking ever to change existing conditions or to create new ones. On the other hand is a passive element—the anvil—which, consciously or unconsciously, accepts conditions as they may exist and has no desire for change. Even he who is unfamiliar with a particular field, or who may even be ignorant of its very existence, must be classed with the anvil and must be given a share of responsibility for the finished product.

The influence of the anvil in the shaping of raw material is negative, but it is real. The hammer chooses the form which is to be shaped, and the anvil, by its resistance to the blows of the hammer upon the raw ma-

terial, assists in the creation. By its capacity or by its defects it may limit or prevent the achievement of the perfect product desired by the hammer; and therefore, whether the final product be good or evil, the anvil must accept a full share of responsibility for the part it has played.

The part of the hammer is the better part, but, with the tremendous range of activities open to mankind, it is obvious that no one can always pertain to the hammer. At the same time, it is undeniable that no one should always be of the anvil. In the fields open to him a man should play an active rather than a passive part. The Army, for example, has always been and always will be in a state of continual change. This change will be along lines of improvement or not according to the manner in which the active agent works. It then behooves us—all of us—who belong to the Army, to leave the ranks of the anvil in all military affairs (if we have not already done so) and to join those of the hammer. It is thus, and thus only, that we may play an active part in the creation of the future of the Army and that we may see that the changes which come to it are for the better and not for the worse.

The Most American Thing for Our Youth is Military Training

This propaganda against military training in our institutions of learning is the most un-American thing now at large in the mind of the American youth.

It is just a part of the untiring conspiracy to strip this country of her national consciousness and sow those seeds which ultimately shall make her a mere outlying possession of that Europe from which our people fled.

Internationalists are unwilling for our boys to have even two hours of military training every week, lest they become more *national,* lest they thrill when they see their flag, lest they love the Star Spangled Banner more than this international Charleston, lest they esteem Washington, Jefferson, Jackson, and Lincoln more highly than those distinguished Doctors of Discord now practicing at Geneva.

The propagandist must know how to change his bill-of-fare as conditions change. He must know when to serve fear, flattery, ridicule, and inflammatory speech, though it is safe to serve flattery at any season of the year.

And so the college boys are flattered! They are internationalists!

No more for them the cramping confines of a mere nation, their jurisdiction is broadened until the campus is thronged with sudden Alexanders, and through the telescope of strange importance they behold Uncle Sam, an amusing relic of provincialism, wandering in solitary aimlessness on the far-off horizon of the obsolete!

There is nothing comparable to this spree of super-importance upon which the international propagandist leads our college boys unless it be the sudden wealth with which six mint juleps used to dower the gentlemen who imbibed them in rapid succession.

And for good measure our college boys have been served fear as well as flattery. They have been told that if they have two hours of military training every week Uncle Sam will straightway become bloodthirsty, empire hungry!

They have been told that if they should stop being hollow-chested America would stop being free; that if they learned to stand erect their country would stoop to conquest!

The propagandists thought this the very time to inject this nightmare, since America is surfeited with her late experience in the European war!

And so to make our future free from danger our boys are counseled to enter upon a state of utter helplessness.

If some playwright should take this theme, this sudden changing of Uncle Sam into a world-wide bandit as a result of two hours' campus training, such playwright would have a farce which would eclipse all Broadway successes, but it is disappointing to see the propagandist stage this farce in the American college and see our intelligent young gentlemen mistake it for *high tragedy!*

Let us get back to common sense! Let our college boys who vote so overwhelmingly against military training get back to the common sense of their less fortunate fellows—the boys in the fields and factories and offices and stores who eagerly enter our summer training camps.

Military training for the national defense is the most American thing in America! Not only because it fits the boy to do his part if war comes for his country, but because it makes him a stronger, straighter, cleaner, more democratic boy.

Order may be the first law of nature, but order is often the last law of youth. And health and good habits and clear thinking and industry and success follow in the footsteps of physical and mental discipline!

If a boy slouches along, his destiny is likely to slouch along. If he sags at the knees, he is likely to sag at the base of the brain, but if he learns to look a target in the face, he learns to look a difficulty in the face!

If he learns to hit the bull's-eye in military training, he acquires the habit of hitting bull's-eyes all through life.

Organization is the secret, whether it be a boy or a store or a factory or a farm!

The college boys of America should cram down the propagandist's throat this insult to their intelligence, this implication that they are utterly ignorant of their country's history, utterly ignorant of their country's lifelong service for mankind!

If they are logical, our college boys will vote to abolish all athletics, lest they become blind devotees of might, and particularly will they abolish all boxing, lest they become prize-fighters!

As they think it over, let the boys reflect that, far from carrying under his white beaver any plots against mankind, their benevolent Uncle Sam is at the present moment too modest even to demand the payment of the billions due him!

And let them reflect also that if some of their ancestors had not had military training they might not be able to be internationalists now—no, not even Nationalists, for they very probably would be the subjects of a foreign power!

Yes, the most American thing in America is military training for the safety of the nation — and for the betterment of the boys! — *New York American.*

Training That is Needed

The citizens' military training camps have become a well established institution in this country. Every summer they offer to thousands of young men throughout the country a month of wholesome training in patriotic and citizenship ideals. The number attending the camps has grown steadily for several years, and last summer was in excess of thirty thousand. Now the president of the Military Training Camps Association expresses the hope this training soon will be available for at least one hundred thousand American youths every year. The contacts established by these camps, he says, afford a better understanding of the nature and needs of preparedness.

The young men of America, perhaps the citizenship of the country as a whole, need the kind of tonic this camp training affords. There is a lot of loose thinking today about the duties of citizenship, about the obligation to maintain those ideals and principles which have gone into the making of this nation and which must be preserved if the nation itself is to be maintained. The greater the number of young men who are instructed as to their duty to their country, both in peace and war, the firmer will be the basis of national security.—*Kansas City Star.*

A Man's Duty to Defend His Country

The Ohio pastors' convention is opposed to compulsory military training in schools and colleges, and apparently is opposed to military training of any kind, on the ground it "is not for the best interest of the country."

The position that such training is not for the "best interest" of the country is beyond understanding. It is designed to promote the security

of the country, and if the men of the nation had not been prepared to defend it at critical times, even after costly delays due to lack of training, there would be no nation today. Presumably, in the absence of a nation, there wouldn't have been any "best interest," whatever the Ohio pastors may conceive it to be.

But why, in view of its demonstrated value and necessity, should not the training be required of school and college young men of the country? Support of the nation is as essential in the form of defense as in the payment of taxes. But would the pastors advocate "elective" or "voluntary" tax paying? How much support would the country get under such a system? What would become of its best interest, of the country itself?—*Kansas City Star.*

The American Boy's Heritage

What patriotic heritage will remain to the American boy two or three generations hence? Pacifism of the type which can be well described by the adjective "supine" continues its boring from within, emasculating America's history, soiling the names of patriots because they drew sword for their country, vilifying the struggles that gave these very pacifists the freedom of action and speech which they abuse.

What will be left when the pacifists have done?

Place, if you will, beside "The Spirit of '76" on the schoolhouse wall pictures of Fulton's steamboat, the prairie schooner, pastoral scenes, and illustrations of industry. They played their part. But do not take down the three heroic figures with their bandages and their stains of blood.

This nation was conceived in war, preserved by war, made the mightiest nation on earth by war. To deny it is to deny truth. With the exception of one war—the Mexican war—the conflicts engaged in by this nation have been unsought and unavoidable. They have been for liberty and union and democracy.

To teach the child that to wage war is horrible, wasteful, criminal, is right. To teach the child that Americans who have fought, bled, and died for their country are criminals is treason. To teach him that war is to be resorted to only as a final resource is humanity and wisdom. To teach him that war is to be avoided at any cost—cost of home, honor, and virtue—is to teach decadence and degeneracy.

Lexington and Concord. The Minute Men. Ethan Allen and Ticonderoga. Israel Putnam at Bunker Hill. George Washington. Trenton, Princeton, Valley Forge. Burgoyne's surrender at Saratoga. John Paul Jones, the *Bon Homme Richard* lashed to the *Serapis.* George Rogers Clark, the swamps, Kaskaskia, Vincennes, Yorktown, and Cornwallis' submission.

Stephen Decatur, who blew up the captured *Philadelphia* in Tripoli harbor.

The *Constitution* and the *Guerrière*, a British frigate forced to strike her colors for the first time in history. Oliver Hazard Perry at the Battle of Lake Erie. Thomas McDonough on Lake Champlain. Baltimore, Fort McHenry, Francis Scott Key, "The Star-Spangled Banner." Andrew Jackson destroying Pakenham's 10,000 veterans with the fire of his Tennessee and Kentucky riflemen at New Orleans.

Through the Civil War, with Grant and Sherman and Sheridan and Farragut and Lee and "Stonewall" Jackson and "Jeb" Stuart and Johnston.

Then Dewey, Sampson, Schley, Miles, Roosevelt. Santiago, San Juan Hill, Manila Bay.

To Cantigny, Chateau Thierry, Belleau, St. Mihiel, the Argonne.

They are part of the heritage of every American boy. Who shall take them away?

"I have just begun to fight."

"Don't fire, boys, until you can see the whites of their eyes."

"Give me liberty or give me death."

"In the name of Jehovah and the Continental Congress."

"I only regret that I have but one life to lose for my country."

"Our country! In her intercourse with foreign nations may she always be in the right! but our country, right or wrong."

"We have met the enemy and they are ours."

"I purpose to fight it out on this line if it takes all summer."

"Hold the fort! I am coming!"

"Damn the torpedoes!"

"You may fire when you're ready, Gridley."

When these utterances of American Warriors shall be taken away; when they shall cease to inspire American boys with love of their country, pride in her greatness, and the sense of their duty to her in time of peace and war, then indeed shall America have passed into the twilight of nations.—*Chicago Tribune.*

Throttling Patriotism

Radical efforts so to undermine the military strength of the United States that this country would be found unprepared in case of emergency have been exposed so many times that the American people are no longer deceived by the protestations of the pacifists. That many of these men and women are honest in their beliefs and methods does not offset the fact that they give encouragement to the enemies of the United States or that these enemies are aiming at control of American youth for the purpose of weakening the military arm of the United States Government. In pursu-

ance of this scheme, American schools and colleges have been shot through with radical teachings, and outside these institutions the same program of ignoble pacifism has taken form in various organizations known under the generic term of the Youth Movement. They are supported by Americans who know little of their real purpose or the clever use to which their activities are put in seeking to throttle American patriotism and stifle all knowledge of military affairs, reduce appropriations for the national defense and generally return the United States to the condition of military unpreparedness which cost this country so much of blood and treasure as an incident of the World War.—*Boston Transcript.*

Colonel House on Preparedness

Colonel E. M. House, whose interesting memoirs are now being published in *The Star*, was and is a great admirer of Woodrow Wilson. In Mr. Wilson's presidency he was repeatedly sent to Europe to study conditions and report to Washington. He became thoroughly familiar with the views of the chief men of the warring nations. His conclusions on one important point was stated in *The Star* yesterday. Speaking of the President's refusal to adopt the policy of preparedness for the nation Colonel House says:

> But I am sure, given a large and efficient Army and Navy, that the United States would have become the arbiter of peace and probably without the loss of a single life.

Unhappily he could not convert the President to this view. So America was regarded as a neglible quantity in the war, until it had made its supreme effort and had 300,000 men killed and wounded. That was the cost of listening to the pacifists. Is their advice any sounder today?—*Kansas City Star.*

A reasonable system of defense finds its *raison d'etre* in being *not the antithethis*, but *the instrument* of the legal order and of peace.—*Otfried Nippold.*

PROFESSIONAL NOTES

Improved Powder Tray

By CAPTAIN A. C. CHESLEDON,, *C. A. C.*

The tray referred to consists essentiallv of a platform resting on a metal frame, and the whole attached to and braced to the side of the shot truck. (See Figures 1, 2, and 3.) The following are its advantages over the standard tray now in use at fixed major caliber armament:

a. Eliminates the powder serving detail—Nos. 16, 17, 18 and 19, from the gun section. Thus the services of four men are made available for use elsewhere. Due to the fact that the powder magazines in most batteries are generally from one to two hundred feet from the guns, and also due to the necessity for firing the gun as rapidly as possible, it is necessary in most cases to have two powder serving details for each gun. Thus, even for a 2-gun battery, a saving of sixteen men is made. In these days of depleted and under-strength units, it is believed the above advantage is obvious. It is also a fact that the service of the powder tray is extremely heavy work even for very large men, and also, after a certain number of shots—not over eight or ten, this detail invariably slows up, due to the excessive exertion required.

b. A saving of time is effected in loading the piece. From exhaustive tests made, I have concluded that at least ten seconds per shot can be saved in loading the gun by using this tray. This saving of ten seconds per shot is based on tests of only 8- or 10-shot series. In longer firings, more time would be saved per shot, as the powder serving detail becomes more and more exhausted and hence work with greatly diminished speed. In fact, the above detail could only work at top speed for eight or ten shots, when it becomes necessary to replace them entirely or let them rest. On the other hand the truck detail was not fatigued by having the truck loaded with the powder charge in addition to the projectile. The ammunition detail places the powder charge on the truck, and the truck is then rolled to the projectile hoist and a projectile is dropped on the truck. The truck is still in the corridors of the battery, ready to move out at the right instant. With the powder trays now in use, the powder serving detail would have to stagger forward on the run for one hundred or two hundred feet, wait for the projectile to be rammed, and then lift the heavy loaded tray, weighing (for a twelve inch gun charge) over three hundred pounds, up to the face of the breech, hold it there till the powder was rammed, and then gallop back for another load. Continue this operation over a protracted series of shots, say twenty or thirty, and the powder serving detail will be completely exhausted. With the improved tray I have devised, the truck detail runs the loaded truck (with both charge and projectile on it) forward to the breech. The rammer detail steps forward with the rammer, and two men on the truck detail place the head of the rammer on the base of the projectile, the rammer detail rush the projectile forward, and *ram it in one movement* from the truck. As soon as the projectile is rammed, the chief of breech rolls the powder charge from the tray on to the truck, and the rammer detail, with another single movement, push it into the

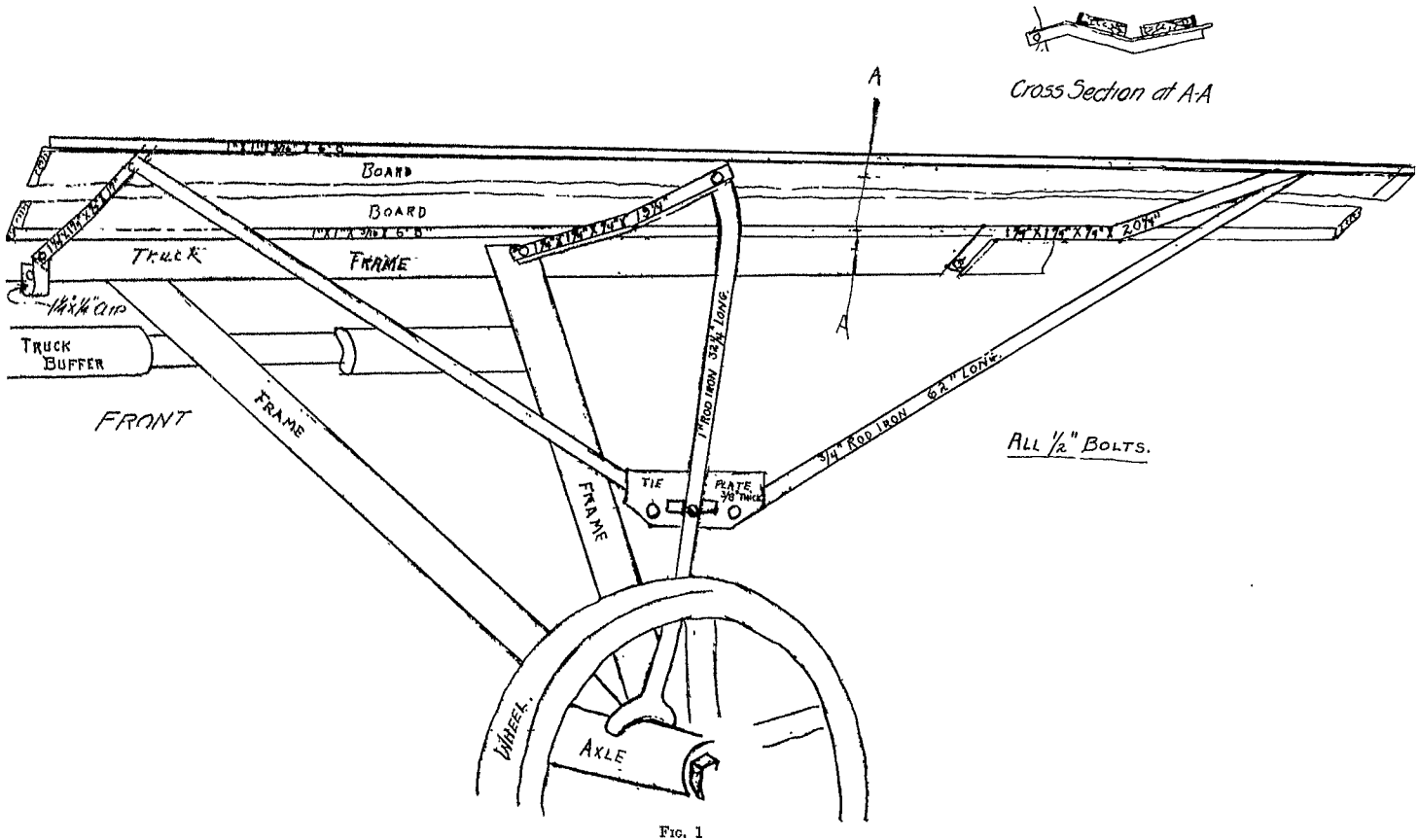

Cross Section at A-A
A
A
BOARD
BOARD
TRUCK
FRAME
TRUCK BUFFER
FRONT
FRAME
FRAME
TIE
PLATE 3/8" THICK
1" ROD IRON 32¾" LONG
¾" ROD IRON 62" LONG
ALL ½" BOLTS.
WHEEL
AXLE

FIG. 1

chamber. The truck is then withdrawn and the block closed. In the above operation of loading the powder from the truck, a saving of ten seconds can easily be made in *loading the gun;* and, furthermore, this saving of time can be maintained indefinitely as it is done with less exertion than any other way of loading. The results of this saving of time can be seen as follows: Assume, in target practice, that ten shots have been fired and four hits made. Using the old tray, assume the gun was fired one shot per minute. Hits per gun per minute is then 0.4. A saving of ten seconds per shot means, instead of ten minutes for firing, eight minutes and twenty seconds for the series, or hits per gun per minute is then 0.48. In action against a hostile fleet, then, for every 12½ minutes the guns were in action, one

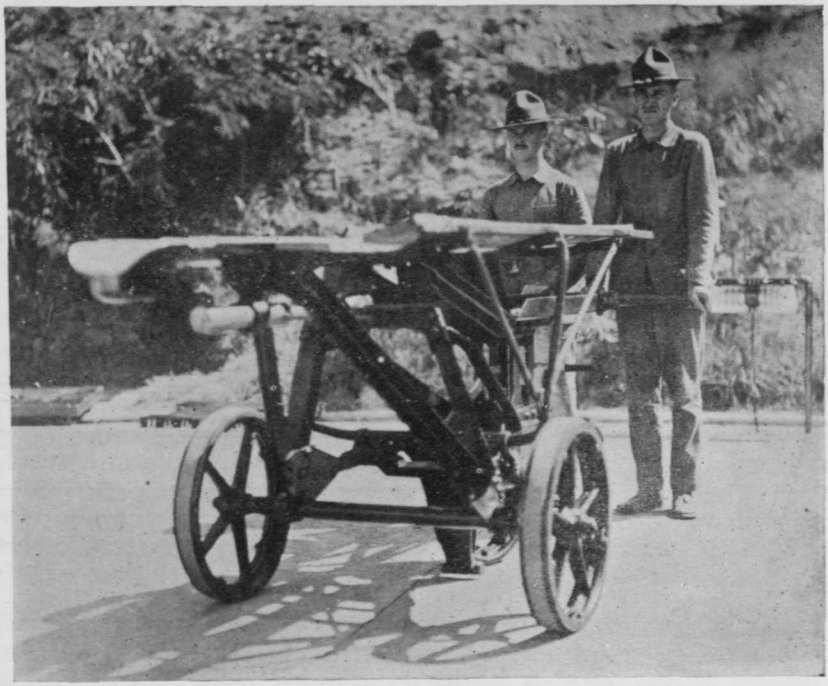


Fig. 2. General View of Truck and Tray Assembled

shot would be gained per gun, by this system over the old system. Since fire effect is the ultimate goal of the service, it is believed this is one factor which will contribute to its realization.

c. No changes need be made in the shot trucks to accommodate the tray, except for the drilling of three ½-inch holes in the side frame of the truck. These holes are for the purpose of holding the bolts of the powder tray. When the latter is not wanted on the truck, the bolts can be taken out by unscrewing the nuts on the ends of the bolts and the tray can be removed. The tray itself can be dismounted from the truck and dismantled in fifteen minutes. All trays and trucks are interchangeable. The only other change necessary in materiel is increasing the length of the rammer to twenty-four or twenty-five feet, if a rammer of such length is not already in use. This is necessary, due to the fact that the shot is *completely rammed from the truck.*

d. The cost of this tray is negligible and the work can be done locally. The material for the tray I devised was secured from scrap material and the work was done by a battery mechanic with ordinary tools. Angle iron one-quarter inch thick and one inch on the side is sufficiently heavy for the tray platform. The main brace which rests on the axle of the truck should be 1-inch round iron, and the side braces, which support the ends of the truck, can either be ¾-inch round iron or angle iron, About twenty-five feet of angle iron and round iron is sufficient. Two pieces of 1-inch

FIG. 3. TRUCK WITH PROJECTILE AND POWDER CHARGE ON TRAY

board, six to seven inches wide and fourteen feet long are necessary for the platform of the tray. However, it may be advisable to use sheet iron for this surface. Also about sixteen small bolts and nuts are necessary to hold the parts in place. The detailed cost is as follows:

Iron, 25 lineal feet for braces and supports for tray, including bolts with nuts, and sheet iron surface (if sheet iron surface is desired	$ 5.00
Labor	5.00
Total cost	$10.00

e. The above tray can be used with disappearing armament as well as for barbette guns for which it was specifically designed.

Artillery Ordnance Development

EDITOR'S NOTE.—*The following notes were compiled in the office of the Chief of Coast Artillery by Major Oliver L. Spiller, C. A. C. Credit is accorded the monthly Digest of Activities of the Ordnance Department for much of the information contained herein.*

37-MM. ANTIAIRCRAFT MOUNT.—*a.* During the World War there was a requirement for an antiaircraft gun between the .30-caliber machine gun and the 3-inch antiaircraft gun. Development of the .50-caliber machine gun has helped to span this broad gap, but still has left room for an intermediate caliber. Tests at the Aberdeen Proving Ground made with the 37-mm. ground gun showed that this caliber of projectile fitted with supersensitive fuse is very destructive to airplanes.

The 37-mm. automatic guns under development for aircraft purposes do not have sufficient muzzle velocity for antiaircraft purposes. It was therefore decided to undertake development of a 3000-f. s., 37-mm. full automatic antiaircraft gun.

An experimental 37-mm. full automatic gun of low muzzle velocity had been designed as an aircraft gun by Captain Jervey. The feed mechanism of this gun

operated on the cannon principle and appeared to be suitable for use with a higher-powered gun.

At the same time Mr. John Browning of the Colt Company became interested in the antiaircraft problem and undertook development of a similar 3000-f. s. antiaircraft gun. Mr. Browning's gun was completed and delivered to the Aberdeen Proving Ground for test during the past summer. The automatic feed mechanism functioned perfectly, and the rate of fire of the gun was found to be about 120 shots per minute. Further tests are to be conducted after steps have been taken to remedy certain defects which were observed at the first firings.

b. An experimental antiaircraft pedestal mount was also manufactured at Watertown Arsenal for 37-mm. full automatic guns. The mount is provided with very fast elevating and traversing mechanisms, such as will permit the gun to be kept continuously trained upon a target one thousand yards or more away and moving at a speed of 160 miles per hour. An experimental open sight will also be provided for this mount, on which vertical and horizontal deflections can be set off. At the present time it is proposed modifying an R. A. corrector for use with the 37-mm. 3000-f. s. guns. The R. A. corrector, together with a self-contained height finder for measuring altitudes, will provide the necessary fire-control apparatus.

This experimental mount is so designed that either the 37-mm., 3000-f. s Jervey gun or the 37-mm. 3000-f. s. Browning gun can be mounted interchangeably. The design of a mobile mount for these 37-mm. 3000-f. s guns is also in progress. It is believed that when these guns are fully developed, they will be used in batteries of eight or twelve units.

The projectile for the 37-mm. gun weighs 1¼ pounds. It is filled with high explosive. Tracers are also under development for the 37-mm. projectile. The 37-mm. projectile has an effective range of about 3500 yards.

.50-CALIBER MACHINE GUNS.—*a.* A project has been undertaken for the development of a heavy, mechanically-controlled antiaircraft mount for the .50-caliber machine gun. The first step in this development program will be to mount one of these guns on the experimental mount, 37-mm. antiaircraft, Model 1925, at Aberdeen Proving Ground, with one, and possibly two, suitable telescopes mounted on the carriage for use in controlling the laying of the weapon.

b. Preliminary experiments with the .50-caliber armor-piercing tracer bullet indicate sufficient promise to manufacture a small quantity of this type of ammunition for an Ordnance test.

Very promising results have been obtained with the recent types of .50-caliber tracer bullets developed by Frankford Arsenal. In a comparative test of four types of this ammunition fired at Aberdeen Proving Ground, three of the types indicated one hundred per cent functioning and traced more than 2200 yards.

c. Two .50-caliber antiaircraft machine guns and ammunition for same have been shipped to Fort Benning, Ga., for an antiaircraft test to be conducted by the Infantry Board with a view to determining the best type of equipment adapted to the type of antiaircraft fire to be delivered by the Infantry.

d. Reports of tests of machine-gun antiaircraft firings indicate that a more substantial and heavier mount will be required for the .50-caliber antiaircraft machine gun to obtain stability required to get a pattern consistent with the possibilities of the gun.

e. An adapter has been designed and manufactured for mounting a .50-caliber A. A. machine gun on the 37-mm. A. A. mount. This gun is being mounted on a 37-mm. mount for the purpose of making studies of a mount with elevating and traversing mechanism and to determine what advantage is to be gained with a

machine gun mounted on this type of mount as compared with the mount provided with free traverse and elevation.

.30-CALIBER MACHINE GUNS.—The conclusion has been reached that, when using the .30-caliber Browning machine gun as an antiaircraft weapon, greater stability is required than is afforded by present types of mounts. Accordingly two of the mounts, Model 1925E, will be altered by a considerable shortening of the legs and, to decrease weight and increase portability, the fourth leg will be removed. These two tripods will then be known as "Tripod, antiaircraft, Model 1925E1 for .30-caliber machine gun"; and will be turned over to the Coast Artillery for test to determine their suitability for adoption in place of the tripod, antiaircraft, Model 1918.

ANTIAIRCRAFT FIRE CONTROL.—*a.* In accordance with the action of the Ordnance Committee, October 8, 1925, instructions have been issued requiring that A. A. sights, Models 1917 and 1918, A. A. data computers, Model 1917, R. A., and A. A. bracket fuse setters be modified for use with the Mark III fuse.

b. A program has been approved and forwarded to the Aberdeen Proving Ground covering tests to determine the accuracy of fire-control instruments used in A. A. fire. These data will be determined by flying the plane over the camera obscura installation at the Proving Ground and determining the actual position of the plane by the camera obscura methods, in comparison with the position as determined by the fire-control instruments, at stated intervals.

c. The purchase of a number of 4-meter, self-contained height finders, to be known as "Finder, Height, 4-meter, T2," has been authorized. When received in this country they will be issued to the Coast Artillery antiaircraft regiments for service test.

ANTIAIRCRAFT FIRING TABLES.—Firings are now in progress at Aberdeen with the Mark III fuse used with the 2400-f. s and the 2600-f. s. 3-inch A. A. gun to determine the following data which will be included in the firing tables to be published in the near future:

(1) Correction of the fuse range in per cent due to a 100-yard linear fuse error along the trajectory.

(2) Effect on range (along the trajectory) in yards, due to one hundred yards change in altitude.

Firings are also in progress to obtain data for the complete firing tables for the 3-inch 2600-f. s. gun in similar form to those recently issued for the 2400-f. s. gun.

MISCELLANEOUS.—*a.* A program for the development of a laboratory mechanical test to determine the suitability of lubricants furnished for use in Ordnance Department automotive equipment has been prepared and forwarded to the Proving Ground for action. The purposes of this program are to discover the influences which cause lubricants to give unsatisfactory service in Ordnance automotive equipment; to determine the mechanical adjustments of the engine and quality of fuel required for satisfactory operation of Ordnance automotive equipment when a lubricant of proven excellence is used; and to develop means for practical test or tests, in addition to the tests now specified, for use in determining whether or not a lubricant is satisfactory for use in Ordnance automotive vehicles.

b. Under date of October 30, 1925, the Secretary of War approved the Range Correction Board, Model 1923, as a type. Storage and issue of this item will be charged to the Chief of Ordnance.

c. Range firing has been completed and report received on the firing of the 155-mm. gun, Model 1920, with the Model E-1 shell. This shell is of the false ogive type, designed for this gun in order to meet the range requirements of 25,000 yards.

The range actually obtained was about 750 yards in excess of the requirements laid down. Groups were not sufficiently large to obtain definite information on the probable error, but the accuracy appears to have been satisfactory.

d. Under date of November 11, 1925, the Secretary of War approved, as a type, the 75-mm. Subcaliber Mount, MI. This mount includes the 75-mm. Gun, Model 1916. The unit, as designed, is mountable on 12-inch B. C., Model 1917. Some modifications of the mount are necessary to make it adaptable to the 16-inch B. C., Model 1919 and Model 1919 MI, and the 16-inch Howitzer Carriage, Model 1920. The ammunition allowance for this subcaliber gun is being given consideration in the revision of A. R. 775-15.

Spotting

By MAJOR SAMUEL T. STEWART, *C. A. C.*

Lieutenant Thompson's article in the January JOURNAL appeals to me as being on the right track. He ignores the deflection which is normally taken care of by the Battery Commander's spotter, but the range is the thing we are after. His scheme permits the spotting section, once the board is set up, to be free from the plotting room,—no bothering for azimuth or cluttering up the data lines. Observation posts can be independent of B′ or B″ unless it be desirable to use intelligence lines with the spotting board in the B. C. Station.

He does what many have advocated,—frees the Battery Commander from the adjustment bugbear and makes him a free lance and puts the work on the Range Section, where it belongs. He does what some one advocated in the JOURNAL last fall, —provides an additional plotting board and is training a reserve plotting section. I have seen the plotting board, used under other systems, as too slow, but believe it would work here, and in quicker time than he states.

One drawback of course. is that it would not check with airplane spotting, but that is another story. If the spotting board be located in or near the plotting room, he would not need the phone from the gun, as in a well-drilled, well-synchronized battery it is pretty well known in the plotting room what ranges are being used to fire the guns, and the ranges called to the guns could be used. Also, in many batteries, mortars and 155's, elevation only is sent the guns and range would have to come from the plotting room. Anyhow, I hope it will be tried out.

History of the Defense of Galveston, Texas

By LIEUT. EUGENE R. GUILD, *C. A. C.*

"Shades of Jean Lafitte!" So might exclaim a visitor in Galveston, Texas, while wandering about Forts Crockett, San Jacinto, and Travis—provided, of course, he was familiar with the romantic history of the old fortifications, for there is little nowadays to remind the beholder that here was the rendezvous of buccaneers and pirates before the beautiful city of Galveston came into being. And, if the visitor were of an imaginative turn of mind, he might envision Lafitte and his cutthroat crew, pistols and cutlasses at their belts, tumbling into their boats for an attack upon a rich vessel in the offing.

To the buccaneering period belonged General Xavier Mina, he who erected the first defensive work in the harbor, an earthwork on Bolivar Point. He also built the first fort on Galveston Island, an earthwork on the bay shore, finished in 1816. Mina was a highly adventurous and picturesque personage, so his rule, while brief, contributed much to the glamour that pervades the Gulf of Mexico.

With the departure of Mina, came Jean Lafitte, the swashbuckling pirate of the Louisiana coast. He established the Lafitte Commune, which in 1817 built a fort on the site of the present medical college. This fort was a two-story block-house, in which was mounted a brass 36-pounder, "Long Tom." Outside was an earthwork mounting a battery of 42-pounders.

The blockhouse was red in color, and Lafitte, being of French descent, promptly christened it Fort Maison Rouge. The storm of 1818 demolished the fort, sweeping the remains into the gulf. No other defense plans being promulgated, the harbor was bare of fortifications until 1830, when the Mexicans established a garrison of twenty-six men on the shore of the bay to protect the custom house.

Another fort was built when Texas became a republic in 1836; an octagonal structure placed near the site of the present Fort San Jacinto. It was named Fort Travis, mounted several 6- and 12-pounders taken from the steamer *Cayuga*, and was commanded by Colonel James Morgan. The garrison was withdrawn in 1844.

The Civil War brought on the construction of various other defenses, ranging from small earthworks to more pretentious strongholds. These were so placed as to protect the city from attack from either gulf or bay, and also commanded the channel and the approach of the G. H. & H. Railroad.

The earthworks at Eagle Grove mounted two 32-pounders and two 18-pounders, placed to protect the railroad.

Ninth Street and Fifteenth Street boastsd a one-gun fort each, shielded with armor-plate. The other fortifications were:

Fort Scurry, at Sixth and Market Streets.

Fort Bankhead, 500 yards northeast of the present John Sealy Hospital.

Fort Magruder, near the gulf shore not far from the present San Jacinto. This was a series of earthworks mounting seven guns.

Fort Sulakowski, at Fort Point, casemated earthworks also armed with seven guns. Barbette mounts replaced the casemating in 1864.

South Battery, on the gulf shore at the foot of Center (Twenty-first) Street.

Obstruction Battery, located on the channel opposite Hitchcock Reef.

Pelican Spit, where earthworks mounting six guns and an eight-inch mortar were thrown up.

All of these were but temporary defenses, and did not long outlast the termination of hostilities. It was not until 1897 that permanent forts were authorized, when the War Department realized the strategic importance of the port of Galveston.

Fort San Jacinto

Fort San Jacinto is situated on the east end of Galveston Island, on a government reservation of 419 acres, reserved for public purposes by an act of the Republic of Texas dated December 9, 1836, and under joint resolution of Congress, March 1, 1845, Texas having become a part of the United States.

Construction of the fortifications began in 1898, and continued until 1901. The first garrison was established April 20, 1898, when Battery "G," First Artillery, arrived under the command of Captain Clermont L. Best.

The new fort was named in honor of the Battle of San Jacinto, in which 783 stout-hearted Texans under General Sam Houston routed Santa Ana and his 1600 Mexicans on the banks of the San Jacinto River, and thus decided the independence of the Lone Star State. In accordance with the custom the batteries of the fixed armament were named after valiant soldiers of the United States Army.

The hurricane of 1900 considerably damaged the batteries, necessitating the transfer of Fort San Jacinto in September of that year to the Engineer Department.

Reconstruction was begun in 1901 and completed in 1906, though not until 1911 did the Coast Artillery Corps again assume jurisdiction.

The storm of 1915 was a repetition of its predecessor, but the damage was not so great and was soon repaired.

Fort Travis

Fort Travis, like its companion, Fort San Jacinto, guards the channel entrance to Galveston Bay. It is situated on Bolivar Peninsula. Construction was begun April 8, 1898, and completed October 25, 1899, on which date it was turned over to the Coast Artillery. The fort was named for William Barrett Travis, beloved by Texans for his courageous stand at the Alamo, when the army of Santa Ana was battering and blustering at the gates of Texan liberty.

Fort Travis and San Jacinto were not intended to be permanently garrisoned, consequently they are in the hands of caretaking detachments. Occasionally, through the target seasons, they are manned by artillery companies, but with the departure of the troops after each short period of training, military activity ceases again.

Fort Crockett

Fort Crockett is situated on a government reservation of 125 acres at the western extremity of the Galveston seawall. It was commenced in 1897 and garrisoned two years later by Battery "G," First Artillery, which had likewise been the first occupant of Fort San Jacinto.

General Order No. 43, Adjutant General's Office, 1903, provided that the fort should be named in honor of David Crockett, American pioneer and member of Congress from Tennessee, who lost his life March 16, 1836, in the gallant defense of the Alamo.

Battery "G" was relieved a few months prior to the hurricane of 1900 by Battery "C," First Artillery, under command of Captain William C. Rafferty.

Following the disastrous storm Fort Crockett was without a garrison for ten years, but in 1911 it leaped into the limelight as a mobilization center during the border troubles. Beginning in January of that year, the First, Second, and Third Provisional Coast Artillery Regiments, made up of picked men taken from coast defenses from Maine to New Orleans, were organized at the post. Commanding the Second Battalion of the First Artillery was Major Frank W. Coe, now a major general and Chief of Coast Artillery. These troops returned to their stations in July and August, 1911, leaving the 127th and 128th Companies, C. A. C., as a permanent garrison at Fort Crockett.

The Fifth Infantry Brigade, commanded by General Fred Funston, and composed of the Fourth, Seventeenth, Nineteenth, and Twenty-eighth Infantry regiments and a company of engineers, arrived at Fort Crockett in 1912. The brigade camped on the parade grounds, with the exception of the Twenty-eighth Infantry, which had its camp on the flats west of the post.

In 1914 the brigade was ordered to Vera Cruz, Mexico, and upon its return once more encamped at the fort. The activities of the coast artillery companies forming the permanent garrison were divided between routine duty at Crockett and patrol duty along the border until the World War.

War with Germany brought fervid industry to the defenses of Galveston. For the first time in its history Fort Crockett put on real military colors. Mobilization of troops from all over the country was carried on at high pitch. It is estimated that at one time there were three thousand soldiers encamped in the vicinity.

Every inch of available space was covered with barracks, kitchens, and warehouses, and the parade grounds were occupied by two regiments of marines under

canvas. Heavy artillery troops were trained to meet the requirements of the expeditionary forces in France, while others were held in readiness to sail.

At frequent intervals replacement troops were sent to France, and in the latter part of the war Fort Crockett furnished from 100 to 200 replacements per month. In addition to training and organizing units for our forces in Europe, the post kept a sharp lookout for German submarines and held its batteries in readiness for action at a moment's notice.

Auxiliary defenses were established at strategic points along the Texas coast. Notable among these were fortifications at Freeport and Sabine Pass, commanding the mouths of the Brazos and Sabine Rivers. These were armed with siege guns and searchlights.

With the end of the war came a period of reorganization and relative inactivity. The garrison was reduced to three companies, the 127th, 128th, and 183d companies, C. A. C. Lessons learned in artillery warfare in France were incorporated into training regulations and the officers and enlisted men began their training in new coast defense tactics.

The news that the post was to be virtually abandoned electrified Galveston in August, 1922, when orders were received at Crockett directing that the fort be left in care of a small detachment, that the companies be rendered inactive, and the personnel transferred to the field artillery of the Second Division at Camp Travis. The people of the city immediately protested the removal of the troops, considering them essential to their safety and welfare. Congressman Clay S. Briggs took the matter up with the Secretary of War and in September, much to the relief of the citizens and garrison alike, the orders were revoked. At this time too, the Sixteenth Artillery Battalion, Antiaircraft, was authorized, and the organization of the unit was effected from the troops of the coast defenses.

Today the fort presents a pleasing and most peaceful appearance—to the casual eye of the visitor—with its green expanse of parade ground, flanked by comfortable looking red-roofed quarters. Its garrison consists of the 9th Infantry of the Second Division, less the first and third battalions and the Service Company.

There is an inexplicable air of mystery and romance still hovering around Galveston and its fortresses—ultra-modern as is the vicinity. It is but a short flight of imagination back to the days when, after firing enough red-hot roundshot to cripple a passing ship, it was the custom of the bold, bad buccaneers to row out and finish the fight with cutlass and pistol.

There are visions of possible future events, also.

Let the visitor conjure up a hostile fleet approaching the city, supplemented by land forces moving northward from the border, and he would see something more than an attractive military post, with troops marching smartly about a well-kept parade ground.

He would see huge gray guns lift their long muzzles into the air to spit tons of armor-piercing steel and high explosive; hidden mortars squatting in their deep pits would rock the ground with their roaring. Miles out in the gulf even beyond the horizon, cascades of white water would appear as if by magic. He would see howitzer regiments rumbling across the causeway to take up positions along Galveston's railroad arteries; an antiaircraft battalion would go into action and he would see, high above the city, black puff balls silently appear, carrying destruction to enemy planes venturing too near. At night, white rays from a dozen mammoth searchlights would sweep sky and gulf.

To do all this, to preserve the security of Galveston and the Texas coast—that is the mission of Fort Crockett, "stronghold of preparedness."

The Non-Knocking Internal Combustion Engine—Its Evolution By the Use of Catalytics

By LIEUT. COL. JAMES PRENTICE, C. A. C.

Fortunately for Germany, but unfortunately for us, a modern development in the fat and oil industry has provided her with means to utilize materiels which hitherto were unfit to eat.

By the so-called methods of hardening fats and oils—that is, by treating them with hydrogen—they are not only converted from the cheaper liquid into higher priced solid form, but their taste and odor are so improved that they might serve for culinary purposes, while without being subjected to the hardening process, they could not possibly be thus employed. Even the various grades of fish oil can thus be rendered available as food materials.

Germany cannot possibly be cut off from the supply of these oils. The fisheries of the Baltic and the North Sea, of Norway and Sweden would place an inexhaustibe and cheap source of fats and oils at the disposal of the German people, to whom an opportunity is thus afforded to remain forever independent of the import of edible fats from the United States.

By this hardening process even the waste fats (feets) obtained in refining can be used not only for soap making, but also for food stuffs. In short, by suitable treatment by hydrogen, all oleagenous matter can be converted into edible substances.

It may appear ot be a long cry from the Allied attempt to starve out the Central Powers by deprivation of fats to taking the knock out of an internal combustion engine and thereby revolutionize the uses of motor-driven vehicles. But is this so? In the above quotation there appears no light on the way in which some German scientists defeated the efforts of the Allies to cut down the German ration of fats. Enters here the magic of *catalytics.*

If the writer were to be asked what was to be the next era of civilization, the answer would be, "We are now entering the era of *catalytics,* the age of *physical chemistry.*" The connection between making rancid fats edible and making an internal combustion engine digest nearly any fuel that can be vaporized is easy to see.

Before going any further let me endeavor to put into untechnical language what is meant by the word "*catalysis.*"

In the presence of, or in contact with, certain metals, chemical bodies undergo changes that not otherwise take place. The reactions induced by the presence of the catalyst may involve merely the splitting up of a single chemical body, of which the decomposition of acetylene in the presence of finely divided nickel is an instance, or the combination of two chemical bodies which, but for contact with the catalyst, would have retained their composition unchanged, although in contact with one another. The hydrogenation of the fatty acid where hydrogen and the fatty acid are brought into contact in the presence of a suitable catalyst is an instance of the latter kind of reactions.

It was this latter reaction which saved Germany the anguish of partial starvation. What was done? They merely introduced rancid or low grade fats into a retort provided with agitating blades where, after certain temperatures and pressures had been attained, there were also introduced streams of nickel oxide and hot hydrogen gas. At the end of a certain period the mixture was drawn off, forced through a filter press and allowed to cool The resulting product was a beautiful, odorless and tasteless white lard just like our Crisco and various other substitutes for lard and butter made from cocoanut, peanut and cotton seed oils. Today this is the commonest and greatest use of the principle of Catalyzation. Nickel is only one of thousands of catalysts. The above incident is used to arouse the interest of lay readers to a new and little known art that promises to revolutionize every process of chemistry known of and radically to alter our methods of refining and using hydrocarbons. The ultimate effect on the internal combustion engine is bound to

have a profound influence on the art of war since it will enlarge the use of motor vehicles, because engines properly catalysed cease to knock.

It is only after many years of study and the expenditure of considerable time and funds in experiments that the writer goes so far as to announce any such a statement. It is only because he has for years been able to propel a motor vehicle under conditions where all others failed that he feels that the attention of other and more capable experimentalists should be called to this development in order that the army may reap the full benefit of this discovery.

It is now about thirty years since it was discovered that by burning a gas flame in contact with a mantle or shroud of woven wire made of certain rare earth metals the combustion was made more perfect, smoke was eliminated from gas jets and that a higher percentage of the energy of combustion was turned into light. The commercial application of this principle is the Welsbach burner which nearly dethroned the incandescent lamp and gave the illuminating gas industry a new lease on life.

Those of the readers who operated automobiles or even stationary engines in the early days of their development perhaps recall the frequency of the need to take down and decarbonize the engine. They will recall the violent knocking that resulted from even the shortest period of full or overloaded operation. It was soon appreciated that the formation of carbon was the principal cause of engine failure and that knocking was an invariable accompaniment to engine scoring and stalling. This problem has never been fully solved and its solution is bound to have a profound effect on the design and use of internal combustion engines and thence on the use of motor vehicles.

To stop knocking, drivers enriched their mixture. The enriched mixture only makes things worse because some of the fuel undergoes dissociation due to heat and pressure in the absence of an abundant supply of oxygen. This wasted fuel and shortened the time between overhauls.

It is pretty well known now that knocking is caused by the impact of an explosive wave on the walls of the cylinder. The wave in question in an internal combustion engine travels at about four times the velocity of sound. Sound travels about 1100 feet per second. The cause of this wave is detonation at some point in the explosive chamber. A point suitable for the nucleus of such a wave would be an incandescent point of either iron or carbon deposit. A dirty engine is full of such points of origin for detonation waves. At times of overload there is abnormal pressure and abnormal heat; the tendency to knock is increased; and as the engine gets dirtier the tendency to knock sets up at lighter and lighter loads until finally the engine becomes practically useless until cleaned out and refitted with new piston rings that stop the oil.

It does not take nickel or a rare metal always to make a catalyzer. Carbon and iron in certain states of crystalization become effective catalysts. Knocking in engines is invariably caused by catalytic action because catalytic action promotes chemical changes and it is sudden chemical changes that cause detonations and explosions.

There are catalysts and catalysts. The strongest one now known is a salt of the rare earth metal palladium. In the presence of a palladium salt any other catalyst is impotent, as it were. If, for instance, one introduced a palladium salt into an explosive bomb and in another part of the bomb, or even all through it, one introduced some catalytic carbon crystals, the resulting explosion would give the reaction characteristic to the palladium catalyst, not that of the carbon catalyst.

Palladium, unfortunately, is very rare and hard to procure at any price. The writer secured one-half ounce of an impure salt at eighty dollars and had another quotation for an ounce at ninety-five dollars if a notice of six months were given. Naturally his thoughts turned to cheaper and more available substitutes. On noticing

that there was seldom or never smoke coming out of the Welsbach burner his thoughts naturally turned to Thorium and Strontium, the commonest metals in the mantle. To line an engine with mantles, damascened in, much as battery materiel is placed in a storage battery was the next natural step. It worked but was short lived. The next step was to find a heat resisting glue. This was found after many years of trial and disappointment. Having the glue, matters became easier and material after material in varying quantities was tried out. The result is an explosive lining that will eliminate carbon for sixteen thousand miles of use and an engine that heats only under the most persistent and strenuous use at full and overload.

Later on it was found that it was not Thorium or Strontium that was the master catalyst but an impurity in the mantle. This impurity, as obtained in a salt, is now used with more astonishing results.

The manner in which a catalyst eliminates knocking is only surmised. The greater part of the evidence goes to show that the non-deposit of carbon on the treated surface of the explosion chamber and the top of the piston is the cause. But there is a strong tendency to believe that the explosive wave originating at the ignition spark travels much faster along the catalyzed surface of the roof of the explosion chamber than it does through the main volume of explosive mixture and that the main explosion is met by the wave of the catalyzation. This is bound to have a neutralizing action on the impact effect of the main wave.

The prevention of carbon deposits is undoubtedly caused by the more perfect combustion that takes place on and near the catalyzed surface. Carbon in contact with oxygen or hydrogen, in the presence of a catalyst and under the influence of pressure and heat, is quite liable to form a gaseous mixture with accompanying heat.

There is another aspect to the matter which when once understood and placed under control will explain certain gains in power without the accompaniment of corresponding heat. Reference is made to "molecular expansion."

According to the law of Avogardro, "all molecules occupy the same space," would it not then be reasonable to assume that if, in the presence of certain catalyzers, certain explosive mixtures produced gaseous products involving a greater variety of molecules and really a greater number of molecules, there would result a pressure due to molecular expansion unaccompanied by heat. It is this phenomenon that accounts for certain pressures in the earth accompanied by the emission of cold gases and by the expansion of enormous volumes of the earth's crust.

Recent researches for catalysts in oil-bearing shales have revealed the presence there of minute percentages of nickel and certain other catalytic salts of the rare metals. Petroleum is a catalytic product.

Now as for the sources of the most active and suitable catalysts for use in engines, it may be stated that the Monazite Sands of India and Brazil appear to be the most promising. Fortunately there have recently been discovered vast deposits of this sand in the United States. Unfortunately the sand here is low-grade ore and requires more labor and power to reduce.

The procurement of the high grade catalysts from the sand is effected by various methods. Solution and precipitation is the commonest method but a new electrolytic process promises to make the supply abundant and reasonable in price. It is predicted that an ordinary engine can be treated to run fifteen thousand miles for about twenty dollars.

We come now to the efforts of certain motor manufacturers to eliminate knocking by the use of dopes or anti-knock solutions introduced into the gasoline. There was recently a newspaper scare about the poisoning of some employees of the Standard Oil Company in New Jersey, by exposure to tetra-ethyl-lead. It is a matter of common knowledge among the manufacturers of hydrogenated fats that the

most deadly enemy of their catalysts, such as nickel-oxide, is lead. The writer resorted to the killing of catalysts many years ago by the introduction of catalyzer poisons, among them various lead solutions and pastes. They worked but at what a price! To think of using a variable catalyst is to fly in the face of reason. What is needed is to get uniform catalyzation. This can be attained only by lining the engine explosion chamber with catalytic powders, uniformly spread and of uniform quality and by carefully avoiding the use of fuels that are known to poison the catalyst used.

One of the greatest obstacles to success along this line is that sulphur is a poison for many of the best and cheapest catalysts. Sulphur is found in nearly all the best brands of gasoline and the result is that we are driven to a limited list of rare earth salts in seeking a potent and durable catalyst for automobile and tractor engines.

The elimination of sulphur from gasoline appears to be in sight now, due, strange to say to the catalytic action of a very common material, fuller's earth. A patent very recently applied for uses it, and its commercial application shows a marked saving in the cost of refining. This increases the chance of the early adoption of catalysts of low price and a more general use of non-knocking engines.

Back Pay, Pension and Insurance

Editor's Note: Every married officer and enlisted man in the Army should be thoroughly familiar with the rights which accrue to his wife upon the occasion of his death. Furthermore, he should see that his wife understands these rights, and he should secure and prepare the necessary papers, that she may not be unnecessarily handicapped and delayed after his decease. In this connection, a memorandum recently issued in the Harbor Defenses of San Francisco for distribution among the enlisted men of the command, contains detailed suggestions of such importance that it is given below in full. Attention is also invited again to pages 573-74 of the Coast Artillery Journal *for January, 1926.*

To: The married men of the command:

1. In case of your death, your widow is entitled—

a. To your pay from date of your last pay day to the day of death. In addition, she is entitled to the gratuity of six months' pay.

In order to collect these, she must file a claim on blank form No. 2971, *Application of Widows for Arrears of Pay and Allowances including bounty due from the United States.* This application shows date and place of birth of deceased and date and place of marriage. When properly executed, it should be mailed to the Auditor for the War Department, Washington, D. C. AR 35-1540 covers the subject of "Gratuity upon death" and should be read by all concerned.

b. To a pension dependent on rank held by the deceased. This pension is as follows:

	Per month
Privates and non-commissioned officers	$12.00
Second Lieutenants	$15.00
Captains	$20.00
Majors and Lieutenant Colonels	$25.00
Colonels and Generals	$30.00

In addition there is from $2.00 to $6.00 per month for each child under sixteen years of age.

In order to initiate this pension an application should be forwarded to the Commissioner of Pensions, Washington, D. C., asking for blank form No. 3-006, *Widow's Claim for Pension.* This form requires applicant to state her age, place and date of birth, date and place of enlistment of deceased, prior service of deceased, date and place of marriage and by whom married.* Names of children with date and place of birth.

Note: If there was a prior marriage of either, the name and the date and place of death or divorce of the former consort, or consorts, should be stated.

c. To the amount of government insurance held by you, if you have designated her as your beneficiary.

To collect this insurance she must file, in duplicate, blank form No. 514, U. S. Veterans' Bureau, Claims Division. The following facts will have to be stated on the form:

(1) Did the insured have a will.

(2) Date of birth of applicant.

(3) How many times has insured been married.

(4) How many times has applicant been married.

(5) If either had been married before, a certified copy of court decree of divorce, or a certificate of death of the deceased spouse of former marriage must be filed.

(6) A copy of record of marriage of insured and beneficiary.

(7) Where had insured lived for last five years.

(8) Date of birth of insured.

(9) List of surviving relatives of insured. This includes parents, children, brothers, sisters, uncles, aunts, nephews, and nieces.

This form must be sworn to before a notary public and forwarded to the U. S. Veterans' Bureau, accompanied by the Insurance Policy. If the latter has been lost, proper affidavits must accompany explaining the loss.

d. To the amount of Adjusted Service Compensation (only to those who served during the World War, except to commissioned officers of the Regular Army). This is the so-called Federal Bonus. You should have a yellow "adjusted service certificate" which your widow will have to sign before a notary public or a Postmaster and forward to Washington, D. C.

2. It takes some time to adjust the above. There will therefore be an interim when your widow may be sorely in need of financial assistance. To cover this contingency the Army Relief Society stands ready to provide the necessary assistance. The Adjutant of the command with which you are serving will know of the local representative of the Army Relief Society and he will be glad to arrange a conference. The assistance given by the A. R. S. will be either a gift or a loan.

3. This whole subject is one we hesitate to discuss with those who should be most interested, but it should be done, as it will relieve much anxiety during the distressing period of re-adjustment. I advise you all to collect the papers indicated above, put them in an envelope, and file them where your wife has access to them.

Half Century Since First Telephone

The first telephone message was sent in 1876, fifty years ago. So great has been the growth of the system that now, in 1926, 67,700,000 telephone conversations take place each day. The two telephones of 1876 have increased to 16,000,000 instruments today. The first telephone line of thirty feet has grown to a network of more than forty million miles of wire; and switchboards, buildings, pole lines, cables, conduits, and other forms of plant have been constructed, costing over $2,500,000,000.

As President W. S. Gifford, of the American Telephone and Telegraph Company, recently said, "The advances which have been made during the first fifty years of the work of the Bell System are unparalleled in the history of communication. They are contributions which will make forever memorable this epoch in our progress. We are now at the beginning of a new era filled with boundless opportunities for advancement in the business and science of telephony. Upon the foundations that have ben so securely laid, we can look forward to the telephone system of the future, which in effectiveness and useful service, will surpass all that has gone before."

The National Matches

The national matches are the culmination of the year's shooting, indoors and outdoors, with both small-bore and service weapons, and, to the rifleman, correspond in importance to the world series to the baseball fan or the Indianapolis Speedway races to the automobile speed lover.

These matches were first held in 1903, and last September marked the twelfth time they have been contested at Camp Perry, Ohio, probably the best equipped range in the world. This range, beautifully located on the shore of Lake Erie, about thirty miles east of Toledo, was, until last year, considered ample for decades to come. The entirely unlooked for increase in attendance has signified to those in charge that the shooting game is afflicted with "growing pains" and that the 1923 suit has been outgrown. The necessary improvements and enlargements are in progress and every effort will be put forth to accommodate the shooters this year.

Some idea of the attendance may be had from the fact that numbered among those registered last fall were 44 National Guard teams, 17 civilian teams, 200 civilian individuals, 125 civilians as members of C. M. T. C. teams, 62 college men in R. O. T. C. teams, half a hundred police officers, 80 members of the Winchester Junior Rifle corps, as well as service teams from the various branches.

Ten thousand dollars in cash prizes were distributed, and, from the standpoint of the average shooter, attendance is worth while, as, under the plan for the distribution of prizes, one man in every four received a part or all of his entrance fees back in cash prizes. In addition to the cash prizes, trophies worth thousands are in competition, many of which have been in competition for more than a generation.

One feature of the National Matches which is very attractive to the civilian rifleman is the Small Arm Firing School. In this, each individual wishing to take the course of instruction is assigned to the squad under the guidance of a competent instructor who is picked from among America's finest riflemen. It should be stated that quarters, cots and bedding, arms and ammunition are furnished free, the only expense being for meals, which may be had at a very nominal cost.

The matches embrace every variety of shooting from the small-bore up to 200 yards, to the service matches from 200 to 1000 yards, as well as pistol and trapshooting. The man to whom powder burning is a joy, and who may for any reason find himself limited in the pursuit of his hobby, will find ample opportunity at the National Matches for the fullest realization of his ambitions.

Old Forts to be Sold

A bill which passed the Senate last month provides for the sale of many famous old forts and military reservations scattered from Maine to Washington. The proceeds are to be used for the construction of quarters and other buildings at permanent posts.

Some of the battle-scarred fortresses to be disposed of are: Fort Morgan, Ala., bombarded by Farragut in his attack on Mobile; Fort Jackson, La., the scene of a sharp fight prior to the capture of New Orleans in the Civil War; Fort Dade, Florida; Fort Andrew, Mass.; Fort Schuyler, N. Y.; Forts Pike and Macomb, La.; and Key West Barracks, Fla.

Portions of the following posts also will be sold: Forts Barrancas, Fla.; Howard, Md.; Taylor, Fla.; Crockett, Tex.; Wingate, N. M.; and Casey, Wash. San Diego Barracks, Calif.; Jackson Barracks, La.; and Fort Hunt, Va., are likewise slated for disposal.

MILITARY NOTES

furnished by

THE MILITARY INTELLIGENCE DIVISION, G. S.

Italy

ARMY REORGANIZATION.—The bill designed by Mussolini to effect a complete coordination of the Army, Navy, and Air Service was passed by the Chamber of Deputies and became law on January 30, 1926. The principal provisions of the new law are as follows:

The number of army corps are to be increased from ten to eleven for Italy proper, with additional special organization of Sicily and Sardinia.

The army corps will consist of from two to four infantry divisions, one regiment of heavy field artillery, one group of antiaircraft artillery, and one regiment of engineers. Depending upon circumstances, Alpine troops, Bersaglieri, cavalry, heavy artillery, and special engineer units may be assigned to the corps.

The thirty infantry divisions will all be of the new "Ternary" model which was tried out at the Italian maneuvers of last autumn. They will consist of one infantry brigade of three regiments and one regiment of field artillery.

Bersaglieri regiments are to become cyclist units armed with machine-guns.

Light and heavy field artillery are to be increased, the former from twenty-seven to thirty regiments and the latter from ten to eleven regiments, corresponding to the number of divisions and corps. Radiotelegraphists will be increased to two regiments, one battalion being assigned to each army corps.

The tank corps remains as an independent organization.

The period of compulsory service will still be eighteen months. The minimum strength of the army is fixed at 150,000 but, when classes overlap, 350,000 men will be in the ranks.

Great Britain

NEW SERVICE RIFLE ADOPTED.—The design of the new service rifle which is to be adopted for the British Army has been completed, although no rifles have yet been produced. The new arm is a modification of the Short Model Lee-Enfield now in use and will probably be designated as the Lee-Enfield Rifle, Mark VI.

Among the improvements are an aperture sight, a heavier barrel, and the discarding of the heavy nose cap of the present model. The muzzle of the barrel will project about four inches beyond the cap of the fore-end and will be provided with lugs for the attachment of the bayonet or grenade discharger. The weight, complete, will be eight pounds nine ounces, which is slightly less than that of the model now in use. No change in ammunition is contemplated at present—the caliber .303, Mark VII, cartridge being retained.

The new bayonet will have a blade eight inches long with a fluted, triangular cross section. It will weigh 6¾ ounces and be attached to the rifle barrel by means of a socket and catch.

Japan

APPOINTMENT AND PROMOTION OF RESERVE OFFICERS.—The Japanese conscript soldier is called in his twentieth year. His first seven years and four months are divided between the active period (of usually one year ten months and twenty days) and the First Reserve. The ten-year period following the First Reserve is spent in the Second Reserve. Upon completing the Second Reserve, service is in the First National Army until the man reaches forty years of age.

Japanese reserve officers are divided into officers of the First Reserve and officers of the Second Reserve. The number of officers in the First Reserve is about sixteen thousand and in the Second Reserve about fourteen thousand.

Reserve officers are junior to officers of the same rank in the active army. They are borne on the list of the division quartered in their native district, but, with the permission of the divisional commander, they may serve in other divisions if it is more convenient for them to do so.

Reserve officers engaged in civilian pursuits wear uniform only in time of war, during training, or at official functions. Reserve officers who are employed as teachers in the schools wear uniform only when on duty.

The First Reserve. Officers of the First Reserve are drawn from three classes:

a. One-year volunteers, who have passed the necessary examination.
b. Officers retired from the active army.
c. Warrant officers and non-commissioned officers of the First Reserve who are considered fit for promotion to commissioned rank.

Most of the reserve officers of the junior grades are drawn from the one-year volunteers. Upon joining a unit, these volunteers are graded for four months as ordinary recruits. They are then appointed "first-class soldiers" and receive instruction from a specially selected officer of the unit. At the end of the period they are appointed lance corporals. At the end of nine months they may be appointed corporals, but still perform the duties of private soldiers, except for instructional purposes.

At the end of twelve months, the one-year volunteers undergo a practical and theoretical examination. The practical examination for infantry candidates includes command of a platoon in company drill, platoon command duties when acting independently, military sketching, target practice, and fencing. Every one-year volunteer is obliged to present himself for this examination. Those who fail are sent to the reserve as corporals but may subsequently be promoted and given commissions.

Successful condidates are given the option either of continuing for a further period of three months with the colors and, on passing the examination, of becoming second lieutenants of the reserve, or of coming up on each of the two following years for a period of three weeks training in each year and taking their examinations for second lieutenant of the reserve in the second year.

The Second Reserve. Officers of the Second Reserve are obtained from the following sources:

a. Transfer from First Reserve list.
b. Transfer from the active army.
c. Warrant officers and noncommissioned officers of the Second Reserve who have been promoted to commissioned rank.

The Promotion of Reserve Officers. In time of peace, officers on the Reserve List are not promoted, except in rare instances where vacancies occur for which no

unassigned reserve officer of appropriate grade is waiting. This reserve unasssigned list is formed largely from officers transferred from the Active List through the operation of "age in grade" or "service in grade" provisions. As the list of unassigned reserve officers is usually larger than the number of vacancies in reserve organizations, there is seldom an opportunity for the promotion of officers on the reserve list in time of peace.

In time of war, their promotion is based on exactly the same principles as for regular active army officers; *i. e.*, almost wholly by selection.

Reserve officers are informed in advance of the duty to which they will be assigned when called to the colors. Thus a lieutenant knows, for example, that he will be assigned to duty as "platoon commander of such and such company, second battalion, 108th reserve infantry regiment."

While the periods of training for reserve officers have been changed from time to time, the following applies at present:

Grade	*Class of Reserve*	*Year or Reserve Service*	*Period of Training*
			Weeks
1. Field officers	1st	2d	5
2. Company officers	1st	2d and at intervals through 10 years	5
3. Officers formerly 1-year volunteers		4th and 6th	5
4. Field and company officers	2d	2d	3
5. Officers formerly 1-year volunters	2d	2d	3
6. Noncombatant officers	1st and 2d	2d	3
7. Noncombatant officers	1st	4th and 6th	3
formerly 1-year volunteers	2d	2d and 5th	3

It seems quite probable that the whole system of appointment, training, and promotion of reserve officers is likely to undergo very material changes within the next few years. All Japanese males in public schools above the fifth grade, and in many private schools as well, are now taking four hours' military training per week. This training is extended to about half a million youths, and eventually, in the case of college men, will cover a period of many years. The new scheme is aimed at developing an R. O. T. C. similar to our own, but, if anything, much more thoroughly trained. It is believed that the one-year volunteer will, as such, pass away and college graduates basically trained in the schools will need not over six months' active service before being given reserve commissions. Military training in the schools will thus in a few years probably lead to an officers' reserve list several times the size of the present number of reservist officers in the Japanese Army.

Spain

NEW EXPERIMENTAL ACCOMPANYING GUN FOR INFANTRY.—A new infantry accompanying gun was exhibited at a recent exposition in Madrid. The new gun was manufactured at Plasencia by the Sociedad Espanola de Construccion Naval according to Vickers specifications. The first one of the guns to be completed will be issued to the Instruction Battalion at Carabanchel for trial.

The gun has two barrels, one of 40-mm. and one of 60-mm. These barrels are quickly interchangeable. The cartridges are the same size at the base, the upper portion of the 40-mm. cartridge being tapered off to receive the projectile.

The range of the new gun is said to be 3000 to 4000 meters for the 40-mm. bore been so securely laid, we can look forward to the telephone system of the future, which in effectiveness and useful service, will surpass all that has gone before."

France

LESSONS DRAWN FROM THE MOROCCAN CAMPAIGN.—Sufficient time has now elapsed since the close of active operations in Morocco for the study of the campaign to be made with a view to discovering whether or not any useful lessons may be drawn applicable to our own forces.

French officers report that infantry reinforcements sent from France, which had undergone a training course to prepare them for Continental warfare, were greatly inferior to the African units acquainted only with the Riffian tactics. Continental infantry equipment was ascertained to be in many cases unsuited for service in Morocco. A great need was found for additional automatic rifles. The new "Chatellerault" *fusil-mitrailleur* was rushed into quantity production and was found to be a welcome addition to the infantry armament. A new "Vivien-Bessieres" grenade, weighing 450 gr. (including 60 gr. explosives), provided with a time fuze with a range of approximately 180 meters, has been adopted which, it is thought will prove very effective in future operations.

COMPANY OF 6-TON TANKS AT ADVANCE BASE M'JARA

The proportion of artillery to other arms was greatly increased during the 1925 campaign. The 75-mm. gun gave excellent support to the infantry. The 65-mm. mountain guns were employed as infantry accompanying batteries. A great need was felt for light howitzers. The heavier weapons, 120-mm., 145-mm., and 155-mm., played an important rôle in many attacks. The transport of these larger calibers with their ammunition supply proved to be an exceedingly difficult task. Some of these guns are reported to be still sticking in the mud awaiting a favorable season for their removal.

The air force rendered invaluable service in patrolling and in protecting and supporting infantry. However, the importance of air bombing was greatly exaggerated—the effect of bombing small huts or well-sheltered or small enemy groups being negligible.

Tanks were frequently used singly despite official regulations to the contrary. While, in general, the tanks gave satisfactory results, the rapid deterioration of important parts and the difficulty of supplying them with gas, oil, and ammunition was so great as to limit their use in many operations.

The first battalion of tanks arrived in Morocco in May, 1925. In July, the second battalion arrived, which brought the number of tank companies up to six. Each company consisted of the following:

3 combat sections of 3 tanks each, one of which was armed with a 37-mm. gun, the other two with machine guns;

1 headquarters detachment with communication equipment;

1 echelon composed of: 1 reserve section of 3 tanks, 10 tank-carrying trucks (one company was equipped with tractors which towed tank-carrying trailers).
7 supply trucks, light trucks, and trailers;
1 repair section of 1 repair shop and 2 trucks.

Strength of company:

4 officers,
106 noncommissioned officers and men,
13 tanks,
10 tank-carrying trucks,
12 (approximately) transport vehicles.

This special organization was the result of the experiences in Algeria and Morocco from 1919 to 1922, the object being to have light units able to operate independently for several days.

The tank battalion comprised:

1 headquarters (3 officers, 14 men, 4 vehicles),
3 companies,
1 park detachment of 11 men and spare parts.

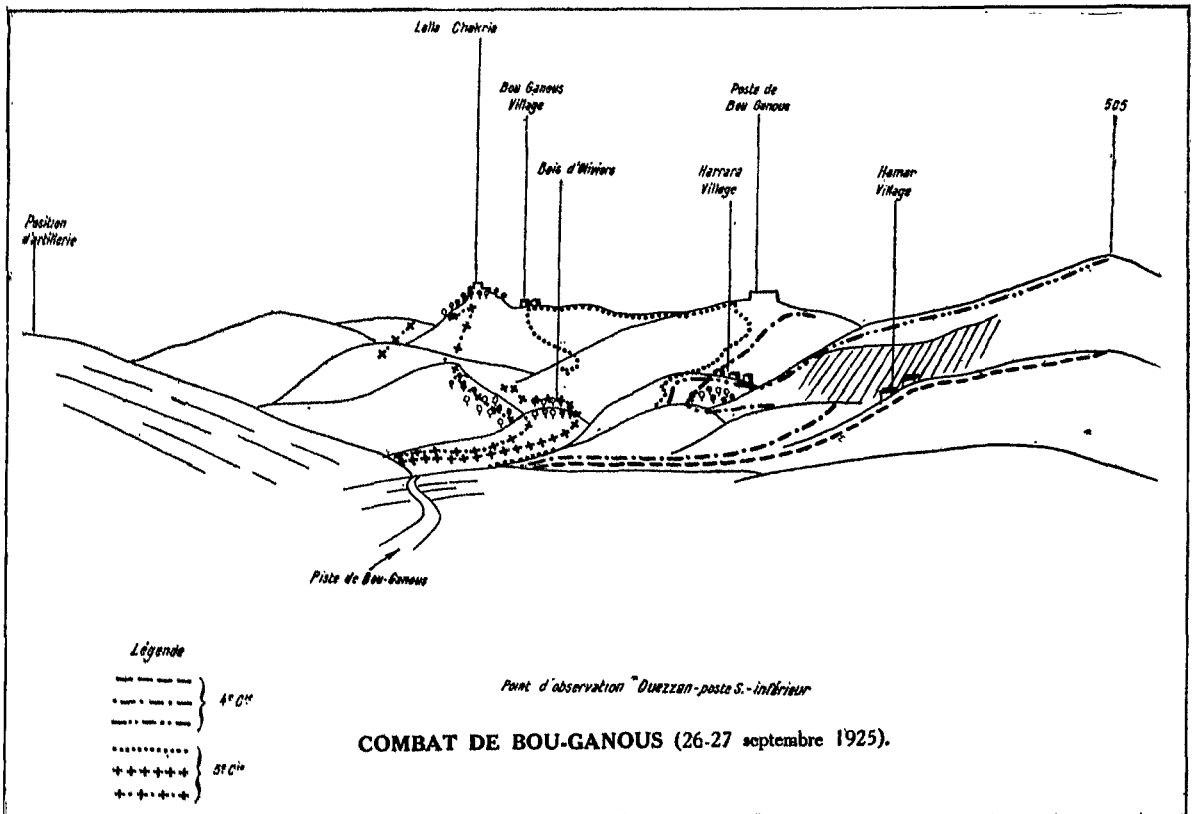
NEAR TAFFRANT

RESULTS

Distances covered by tanks. A company having its tanks transported on trucks made 80 kilometers in 48 hours over very steep ground with many sharp curves. The same company made 54 kilometers in a day's march. Another company made 125 kilometers (Fez-Taza) in three days' marches. Several times the trucks were unloaded so that the tanks on their caterpillars could ford streams or pass over a bridge with logs forming a rolling platform. The 504th Company (September 8) proceeded on its caterpillars a distance of 20 kilometers in the night (7:30 P. M. to 4:00 P. M.) through a very hilly region.

Liaison. On August 25 a section, cooperating in a combat where two Tunisian Battalions were engaged, was working ahead when, suddenly, the Tunisians turned to the right without giving notice of their movement. Fortunately the Commander of the company, having observed the lack of liaison, had time to send new orders to the section.

A company of tanks, placed on the slope of the Djebel Amessef (August 25) at an altitude of 1275 meters, with a group of houses as objective, opened fire on its own infantry who had reached this objective before the tanks.



Point d'observation "Ouezzan-poste S.-inférieur

COMBAT DE BOU-GANOUS (26-27 septembre 1925).

Flank Protection. In some cases tanks have been employed on the flanks; e. g., on August 17 a tank company protected the flank of a group of light infantry whose duty was to organize the post of "Gros Rocher."

Patrolling. On August 26 one section of tank company, which had cooperated in the attack of the Djebel Semiet, patrolled all day long in the vicinity of Msila in conjunction with other troops.

Blockhouse. The 504th company detached one section on the top of a hill. This section constituted a kind of movable blockhouse which could withstand the fire of the Riffian artillery without casualties.

Outposts. Two sections of tanks, placed in front of a line of infantry which had to organize the defense of the post of Issoual, afforded a very efficient protection to the troops.

Moving up from Taffrant for the Attack on Bibane

Medical motor transport. A section of tanks once cooperated in collecting dead and wounded.

Supply transport. On September 15, tank-carrying trucks were used for transporting supplies. On September 20 a tank company succeeded in bringing supplies to the post of Dakar, the tanks towing old sleighs. The chains connecting the two vehicles having broken, repairing took place under fire of the enemy without casualties.

Relief work. Tanks have been used as tractors to tow artillery trucks broken down on account of the very poor condition of the ground.

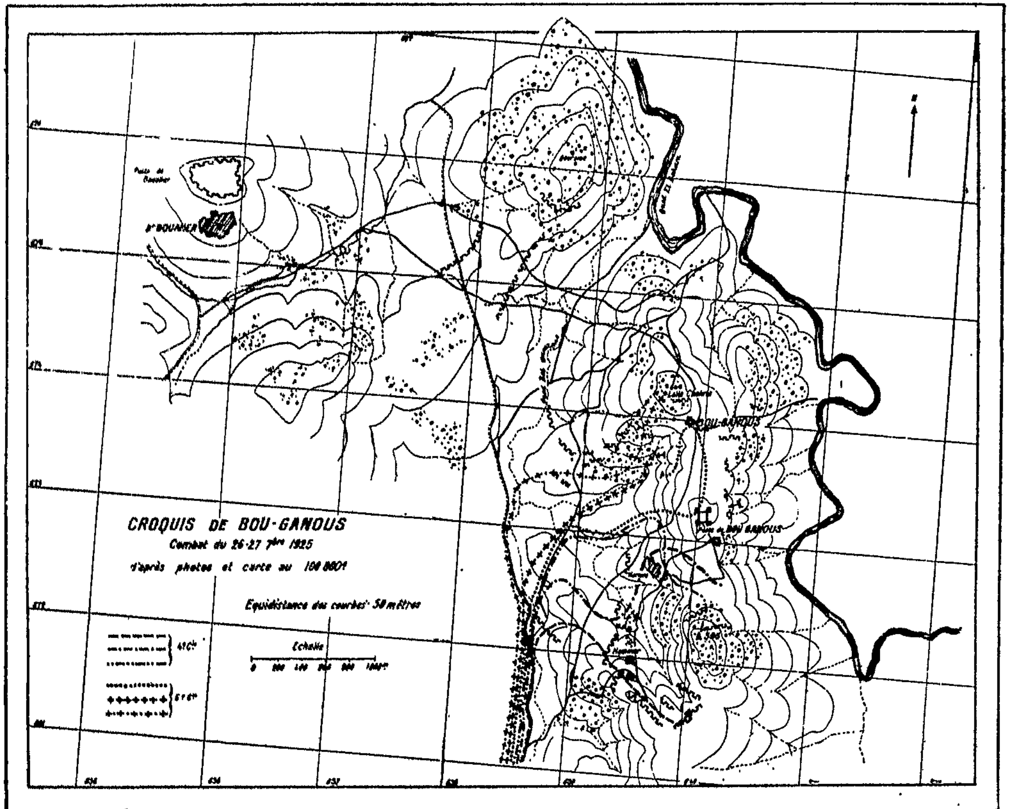
OPERATIONS

Attack of Bou Ganous. The French columns, whose duty it was to carry supplies to the little garrison of the post of Bou Ganous (forty men strong, 8 kilometers north of Ouezzan), being continually harrassed by the enemy, the military authorities decided to attack the rebels, drive them off, and establish an important fortified position in this region—including point 505 and the height of Lalla-Chakria.

The route followed by the troops passed between two heights:

Hammar—hill 505 at the right,

Lalla-Chakria at the left,


CROQUIS DE BOU-GANOUS
Combat du 26-27 7bre 1925
d'après photos et carte au 100 000e
Equidistance des courbes: 50 mètres
Echelle
0 200 400 600 800 1000m
Bt BOUAHER
BOU-GANOUS

both of which commanded many ravines which the columns had to cross. Two tank companies were attached to the columns. The operation had been carefully prepared and the ground examined from a captive balloon, as well as searched with a telescope from a height situated to the north of the camp of Ouezzan. A plan of close cooperation between infantry and tanks had been thoroughly studied and adopted. The operation (September 24) was divided into three phases:

a. The tanks were ordered to flank the columns, taking and cleaning up the Riffian positions, viz:
on the right: Hammar and hill 505;
on the left: Lalla-Chakria.

b. One infantry battalion was to push forward to Bou-Ganous, preceded by a section of tanks which was to push beyond this position.

c. Supply service.

The operation took place as prescribed, the tanks starting half an hour before the infantry columns in order to surprise the enemy. Wherever the tanks appeared,

TANK EQUIPPED WITH RUBBER CATERPILLAR TREAD

the Riffians retreated and took refuge either in ravines or in caves. Several tanks covered the openings of the dug-outs occupied by dissidents, thus preventing them from coming out, and aiding the Infantry in mopping up.

CONCLUSION

Organizations. A section of three tanks proved to be the best fighting instrument against an adversary lacking good artillery and anti-tank arms and ammunition. This unit is more supple than a five-tank section, and is easily directed by its chief. Generally engaged in column formation it has been able to execute deployments in the immediate vicinity of the enemy. When loaded on trucks, the section of tanks does not handicap the movement of the columns.

Armament. A section originally had one gun tank and two machine-gun tanks. After the experience of the last campaign in Morocco the proportion was reversed. The tank-carrying trucks proved to be far superior to the tractors used by one of the tank companies due to their simplicity and their transport power.

Materiel. Considering the enormous difficulties of the ground in this country, the tank materiel has proved very satisfactory. The tanks on caterpillar treads have usually run over twenty kilometers a day. Nevertheless, after a long working day, several tanks, if not out of service, at least had breakdowns necessitating difficult repairs.

Tank Crews. The tank crews performed remarkably. For instance, in the fight of August 21-28, a lieutenant succeeded, under enemy fire, in personally repairing a caterpillar out of its rolling platform; although wounded he continued his work.

Liaison. Every time liaison had not been carefully established *before* and during the fight, cooperation was a failure.

Tactical formations. Very often tanks were used in small groups. This method was a consequence of special warfare, but experience has demonstrated that in some circumstances (attack of the Djebel Semiet, October 25) it would have been better to engage the tanks in depth.

Method of attacking tanks. A new method of attacking tanks may possibly be learned from the action of the Druse tribesmen in Syria. The Druses met an attack of tanks as follows: Four men are detailed to attack each tank. Each of these men is equipped only with a short iron bar. They lay in wait in holes and behind rocks until the tank is upon them when they spring upon it and endeavor to stick the iron bar in the track laying mechanism of the caterpillar, a feat which they have accomplished on a number of occasions with comparative ease. This method of attack has proved so annoying to the French that their tanks and armored cars are now covered with barbed wire before going into action.

National defense is the specific function of the army and navy. But the army and navy do not make war. When the people, through their representatives in Congress, declare war, the task of carrying on the struggle devolves upon the army and navy. The army and navy do not even provide the means for the common defense. They take the facilities placed at their disposal by Congress and make the best of them. They can do no more than the people, through their representatives, approve.—*John W. Weeks.*

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the Service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration. R. S. ABERNETHY, *Colonel, Coast Artillery Corps, President Coast Artillery Board.*

Projects Initiated During the Month of February

Project No. 436, Firing Tables for 14-inch Guns, Models 1909, 1910, and 1910 MI, Firing 1660-lb. Projectiles.—The tables were examined by the Coast Artillery Board, and, with minor modifications, found satisfactory for publication.

Project No. 437, Firing Tables for 10-inch Guns, Models 1888, 1888 MI, 1888 MII, and 1895, Firing 617-lb. Projectiles.—These tables were examined by the Coast Artillery Board, and with minor modifications, found satisfactory for publication.

Project No. 438, Firing Tables for 8-inch Guns, Models of 1888, 1888 MI and 1888 MII, Firing 323-lb. Projectiles.—These tables were examined by the Coast Artillery Board, and, with minor modifications, found satisfactory for publication.

Project No. 439, Antiaircraft Machine-Gun Mount, Model 1925-T2.—A representative of the Chief of Ordnance demonstrated to the Coast Artillery Board the action of various machine-gun mounts. After complete study by the Coast Artillery Board it was recommended that the 1925-T2 mount, which has a head height of five feet and construction material of leg and shaft same as in the 1924 mount, be manufactured if immediate production is necessary. This mount is suitable for the .30-caliber A. A. machine gun and may possibly be satisfactory for emergency use with the .50-caliber weapon.

Project No. 440, Arrangement of Equipment in Fire-Control Cars for Exhibition at Sesqui-Centennial Exposition.—The Chief of Coast Artillery directed that the Coast Artillery Board make a study of the fire-control equipment which should be included in each of the fire-control cars of a battery of one 14-inch railway gun which is being prepared for exhibition at the Sesquicentennial Exposition at Philadelphia. After study by the Board, a complete list of materiel and a sketch of the proposed arrangement was prepared and furnished the Chief of Coast Artillery.

Project No. 441, Comments on Report of 55th Coast Artillery on Functioning of 155-mm. Materiel.—Copies of extracts from reports of target practice with 155-mm. guns by the 55th Coast Artillery were furnished to the Coast Artillery Board for its information and for comment. These extracts relate principally to functioning of materiel. They are now undergoing study.

Project No. 442, Firing Tables 10-A-1 for 10-inch Guns, Models 1888, 1888 MI, 1888 MII, and 1895, Firing H. E. Shell, Mark II.—These tables were examined by the Coast Artillery Board, and, with minor modifications, found satisfactory for publication.

Project No. 443, Corrector Scale, A. A. Fuse Setter.—The Commanding Officer of one of the gun batteries of the 62d Coast Artillery (A. A.) has suggested that a change in the manner of graduation of the corrector scale of the A. A. fuse setter be made. This change involves reversing the graduation so that to shorten the time of burning the corrector setting is lowered and to raise the time of burning the corrector setting is raised. The use of a corrector scale graduated in per cent was also suggested. These suggestions are now under study by the Coast Artillery Board.

Project No. 444, Test of Sighting Mechanism T-1, 1925, on 3-inch Antiaircraft Gun, Model 1917 MI.—Two members of the Coast Artillery Board were ordered to Aberdeen Proving Ground to witness the test of the sighting mechanism T-1, 1925, on the 3-inch A. A. Gun, Model 1917 MI. This sighting mechanism is a development of the system discussed in Coast Artillery Board Projects No. 241, 293, and 354. This sight was found to meet all requirements desirable in a fixed antiaircraft gun sight. The Coast Artillery Board recommended that this sighting mechanism be approved for production for all 1917 MI antiaircraft guns.

Project No. 445, Development Program, Long-Range Fire Against Naval Targets, 1926.—The Coast Artillery Board was directed by the Chief of Coast Artillery to prepare a plan of procedure for a development program of long-range fire against naval targets. The plan to contain specifications of work to be accomplished; materiel required for the test; ammunition allowance; commissioned and enlisted personnel by grades and ratings required to carry out the work; and outline of form of report to be rendered upon completion of the test. This program has been submitted.

Project No. 446, Development Program, 1926, Test of Self-Contained Range Finders.—This project involves a test of self-contained range finders employed to determine ranges for fire against naval targets, and is similar in scope to that outlined in the preceding project (No. 445).

Project No. 447, Revision of Target Practice Reports.—The Coast Artillery Board has been directed by the Chief of Coast Artillery to make a study and submit recommendations on the matter of including in all target practice reports on firings against moving water targets, a plot showing the groupings of the several shots about the center of impact, and the position of the center of impact with reference to the target superimposed upon a suitable ladder of dispersion. Recommendations were also desired as to whether or not there should be included in this plot the position of the shots had the firing data been stripped of all ballistic corrections, together with the form of a directive to be placed in the battery commander's narrative report required by Paragraph 31, T. R. 435-55.

Completed Projects

Project No. 434, Modified Impact Board

I—HISTORY OF THE PROJECT.

1. The Impact Board described in paragraph 41, *Training Regulations 435-221*, and constructed at Frankford Arsenal (called Range Adjustment Board, Model M, F. A., 1925) has been subjected to service test and found satisfactory. However, the Coast Artillery Board is of the opinion that there can be designed an impact board which will combine the advantages of the board tested and of the Fire Adjustment Board designed by Brigadier General R. E. Callan, and which will be less elaborate and costly of construction than the board tested. Accordingly the Coast Artillery Board has designed the Modified Impact Board.

II—Discussion.

2. *Description.* The Modified Impact Board consists of a drawing board, 19 inches by 24 inches in size, and a T-square. At the top of the drawing board there is fastened a slide rule for converting a deviation in yards into a deviation in per cent. This slide rule is identical with the slide rule at the top of the Impact Board. The T-square is to be operated with its blade horizontal and its head against the left edge of the drawing board. The T-square carries a slide which can be moved to the right and left. The slide is beveled, and attached to the beveled surface is a scale. This scale has its zero at its center. It is graduated in per cent to the right and to the left of the zero. One more inch is equal to one per cent. The least reading in one-tenth of one per cent. That part of the scale to the right of the zero is printed in

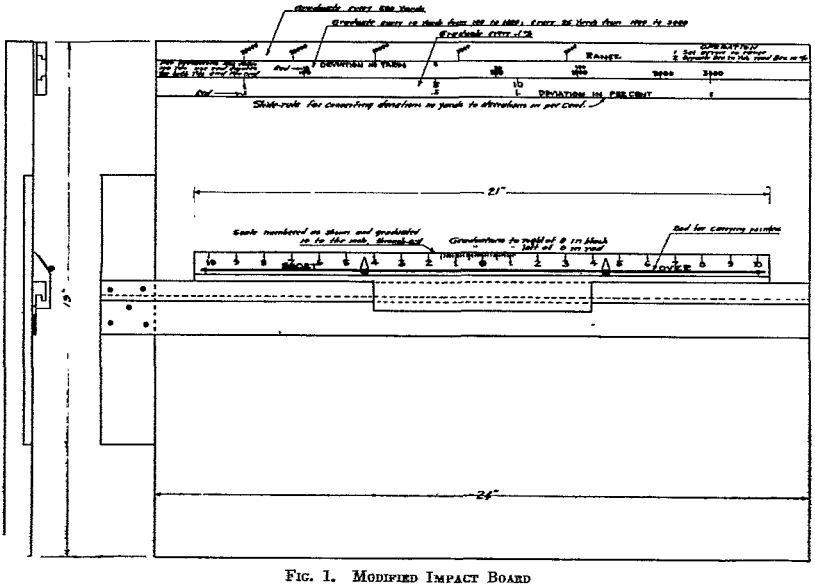


Fig. 1. Modified Impact Board

black and marked $\frac{\text{UP}}{\text{OVER}}$ and that part to the left is printed in red and marked $\frac{\text{DOWN}}{\text{SHORT}}$. Two sliding markers are provided. The Modified Impact Board is shown in Figure 1.

3. *Operation. a.* A piece of cross-section paper (ten divisions to the inch) is fastened to the face of the board so that the vertical lines are parallel to the left edge of the drawing board. A heavy pencil line is drawn over that heavy vertical line of the cross-section paper which is nearest the center of the board. This line is the axis of correction. The vertical scale may be a scale of time of any convenient dimension. If it is not desired to use a time scale, shots may be plotted at equal intervals on the vertical scale.

b. To determine and plot the correction to be applied to any shot by the method of fire adjustment employed in paragraph 41, T. R. 435-221, the T-square is moved so that the edge of the scale is coincident with the line corresponding to the numbered graduation for that shot or at the proper time graduation. The slide is then moved until the zero of the scale is opposite the center of gravity of the deviations upon which the correction is to be based. The intersection of the scale with the axis of correction is the correction in per cent that is to be applied. It is an UP correction if the zero of the scale is to the left of the axis (black reading) and a

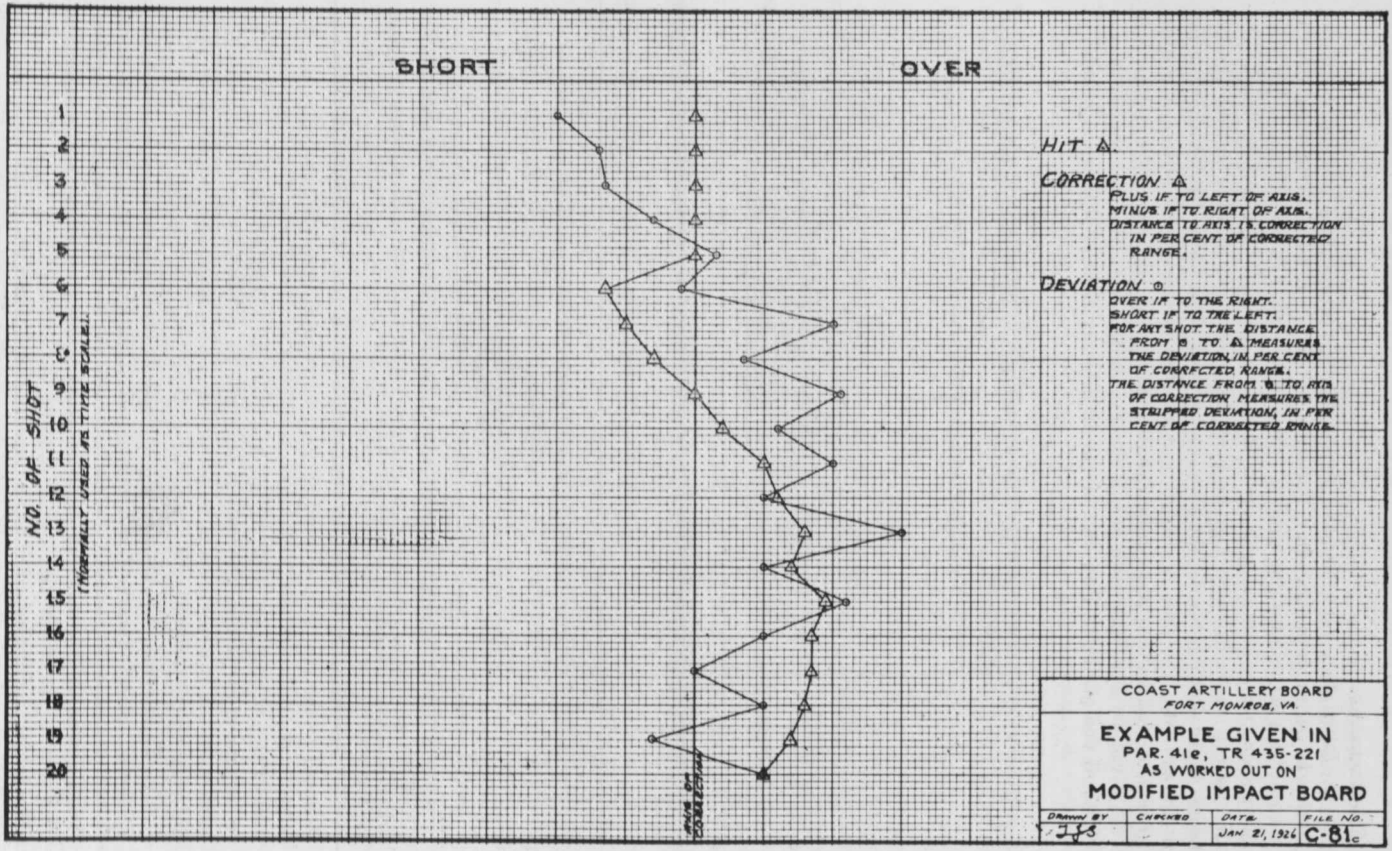

SHORT
OVER
NO. OF SHOT
(NORMALLY USED AS TIME SCALE)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
HIT △.
CORRECTION △
PLUS IF TO LEFT OF AXIS.
MINUS IF TO RIGHT OF AXIS.
DISTANCE TO AXIS IS CORRECTION IN PER CENT OF CORRECTED RANGE.
DEVIATION ⊙
OVER IF TO THE RIGHT.
SHORT IF TO THE LEFT.
FOR ANY SHOT THE DISTANCE FROM ⊙ TO △ MEASURES THE DEVIATION, IN PER CENT OF CORRECTED RANGE.
THE DISTANCE FROM ⊙ TO AXIS OF CORRECTION MEASURES THE STRIPPED DEVIATION, IN PER CENT OF CORRECTED RANGE.
COAST ARTILLERY BOARD
FORT MONROE, VA.
EXAMPLE GIVEN IN
PAR. 41e, TR 435-221
AS WORKED OUT ON
MODIFIED IMPACT BOARD
DRAWN BY
JJB
CHECKED
DATE
JAN 21, 1926
FILE NO.
C-81c

FIG. 2

DOWN correction if the zero is to the right of the axis (red reading). This correction is read to the operator of the range percentage corrector. The position of the zero of the scale is then marked △ on the cross section paper.

c. When the deviation for any shot is received, the zero of the scale is placed at the point indicating the correction that was applied to that shot, and the deviation, after having been converted to per cent by means of the slide rule at the top of the board, is plotted, by means of the scale, on the cross-section paper and marked O and, if desired, with a pin. When pins are used and it is desired to base a correction upon latest deviations only, pins marking earlier deviations may be removed.

d. When the firing is completed the cross-section paper may be removed from the board and provide a permanent record of:

(1) Corrections applied as a result of observation of fire. The distance from any point marked △ to the axis of correction measures the correction: UP if the point marked △ be to the left of the axis (black reading), and DOWN if it be to the right of the axis (red reading).

(2) Deviations from the expected range. The distance from any point marked O to the point marked △ measures the deviation: short if the point marked O be to the left of the point marked △ (red reading), and over if it be to the right (black reading).

(3) Stripped Deviations. The distance from any point marked O to the axis of correction measures the stripped deviation for the shot; short if the point marked O be to the left of the axis (red reading), and over if it be to the right (black reading).

e. The two sliding markers on the scale of the T-square are provided to facilitate the plotting of a zone to serve as a criterion to reject wild shots, as is done on the Fire Adjustment Board designed by Brigadier General R. E. Callan.

4. The Impact Board, described in paragraph 41, T. R. 435-221, has the disadvantages inherent to its number of slides. It is comparatively elaborate and expensive, and slides may stick or warp. During operation, the slides project beyond the edges of the board and may be inadvertently displaced. Except for the slide rule for converting deviations in yards into deviations in per cent, which is common to the Impact Board and the Modified Impact Board, the Modified Impact Board has but one slide. The Modified Impact Board will provide a permanent record of the firing. For the Modified Impact Board the slide rule at top of board and the T-square with its sliding scale should be of arsenal manufacture for use with suitable drawing board, but the whole device can be improvised without great difficulty.

5. In Figure 2 there is worked out the same example as given in paragraph 41 *e* of T. R. 435-221. In this example it is assumed that trial shots were fired at a range of 16,000 yards, the center of impact being 450 yards short of the target. This corresponds to a correction of 2.8 per cent, which may be applied as an adjustment to the estimated velocity on the range correction board and appear in the setting of the ballistic correction pointer on the percentage corrector. A rapidly moving target coming in, at which shots or salvos are fired each minute as in mortar fire, is assumed. The ranges of the setforward points, taken from the plotted course of a hypothetical target, are as follows:

1.	16,700	5.	14,340	9.	12,020	13.	10,100	17.	8,290
2.	16,100	6.	13,750	10.	11,530	14.	9,610	18.	7,900
3.	15,510	7.	13,180	11.	11,020	15.	9,150	19.	7,520
4.	14,930	8.	12,610	12.	10,530	16.	8,710	20.	7,200

The first four shots are assumed to have the following deviations: —350, —210, —200, —90. The corresponding percentage deviations determined for the ranges at which fired from the device at the top of the board are: —2, —1.4, —1.3, —0.6.

As reports of these deviations are received they are plotted as indicated on the diagram and may be marked by pins. Assuming that a correction based on the four deviations may be applied to the sixth round, the sliding scale on the T-square is moved so that its zero is at the mean of the four deviations and this point is marked thus: △. This mean point can be determined by inspection so accurately that the zero of the scale should not miss the true arithmetical mean of the four deviations by more than one of the smallest divisions of the scale. UP ONE POINT THREE (1.3 per cent) is ordered and applied on the range percentage corrector. Shot No. 5 having been fired in the meantime without correction, its deviation is reported too late to affect the laying for No. 6. This deviation is "over 45 yards," which is 0.3 per cent of the range at which it is fired. If now the correction for shot No. 7 is based on the five shots which have been fired, the position of the zero of the sliding scale is estimated and a correction UP ONE POINT ZERO is ordered, the indicated slight adjustment being made to the "read" pointer on the range percentage corrector.

When the fall of No. 6 shot is reported, its deviation "150 over," or 1.1 per cent is plotted and pinned at the point indicated to the right of the correction applied to shot No. 6. The T-square is then moved until the edge of scale passes through the horizontal line on which shot No. 8 is to be plotted and the zero of sliding scale is moved until it is on the vertical line passing through the center of impact of the previous five shots. UP ZERO POINT SIX is ordered. In a similar manner the succeeding corrections are determined. The deviations and corrections are as follows.

Shot	*Yards*	*Per Cent*	*Shot*
7	Over 400	3.0	Total correction for 9; zero correction.
8	Over 150	1.3	Total correction for 10; down zero point 4.
9	Over 250	2.1	Total correction for 11; down 1.0.
10	Over 90	0.8	Total correction for 12; down 1.2.
11	Over 110	1.0	Total correction for 13; down 1.6.
12	Short 20	0.2	Total correction for 14; down 1.4.
13	Over 140	1.4	Total correction for 15; down 1.9.
14	Short 40	0.4	Total correction for 16; down 1.7.
15	Over 30	0.3	Total correction for 17; down 1.7.
16	Short 60	0.7	Total correction for 18; down 1.6.
17	Short 140	1.7	Total correction for 19; down 1.4.
18	Short 50	0.6	Total correction for 20; down 1.0.
19	Short 150	2.0	Total correction for 21.
20	Hit	0.0	Total correction for 22.

Any number or all of the previous shots may be considered in estimating a correction. In the example the five most recent shots only are considered, on the theory that the shots more remote in point of time are of less value as evidence of what may be expected of the next succeeding shots than the more recent ones. Accordingly, after each correction is made on the board, pin No. 1 of the series considered is removed.

6. The use of the Modified Impact Board is not limited to the method of fire adjustment considered in the example in paragraph 5. It can be used with equal facility for any other method of fire adjustment. Where it is desired to plot deviations and corrections in yards instead of in percentages the sliding scale of the T-square can be used without change. Whatever method of fire adjustment be employed and whether corrections and deviations be plotted in percentages or in yards, the slope of the curve of deviations and the relation of this curve to the curve of corrections should be of the greatest value, as they indicate whether or not the shoot is progressing satisfactorily, and whether or not a change in the method of fire ad-

justment is desirable. By means of the graphs obtained from this board interesting comparisons may be made of the results that would have been obtained had some different method of fire adjustment than that actually used for the firing been followed.

III—CONCLUSIONS.

7. The Coast Artillery Board is of the opinion:

a. That the Modified Impact Board is superior to the Impact Board (Fire Adjustment Board Model E, F. A., 1925) in the following respects:

(1) Except for conversion slide rule, it has but one slide instead of twenty.

(2) It accomplishes everything accomplished by the Impact Board and, in addition, furnishes a permanent record and permits of corrections and deviations being plotted to a time scale if desired.

(3) It should be much less expensive to manufacture.

b. That, should the Modified Impact Board be adopted, one should be issued to each battery.

c. That tests have fully demonstrated the advisibility of the use of an impact board of some description.

d. That the Modified Impact Board lends itself better to local construction than does the Impact Board.

V—ACTION BY THE CHIEF OF COAST ARTILLERY.

IV—RECOMMENDATIONS.

8. The Coast Artillery Board recommends:

a. That a limited number of Modified Impact Boards be constructed by the Ordnance Department and subjected to service test.

b. That no more unmodified Impact Boards be constructed pending service test of the Modified Impact Board.

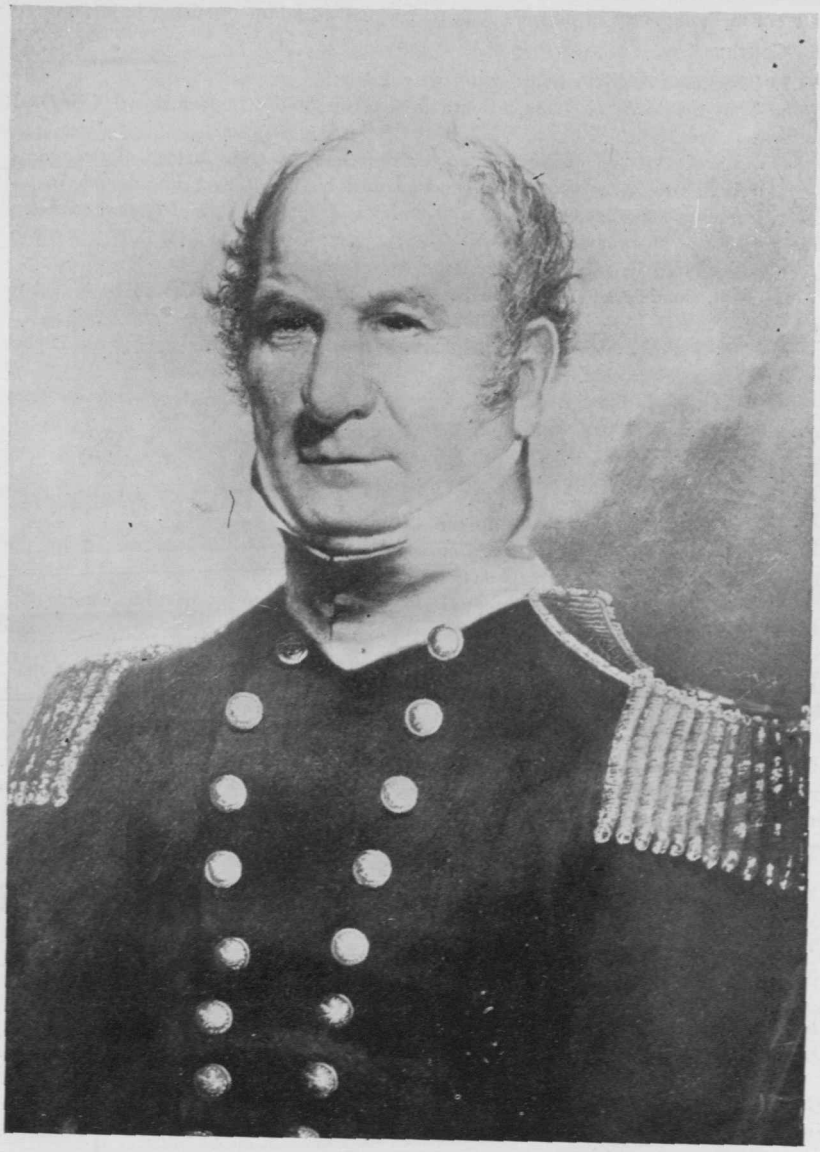
1st. Ind.

413.68/AP12

War Department, O. C. C. A., February 6, 1926—To Chief of Ordnance.

The recommendation of the Coast Artillery Board, contained in paragraph 8 *b* of Coast Artillery Board Project No. 434, is concurred in. With reference to paragraph 8 *a* of that project, information is desired as to the cost of construction of five impact boards of the proposed types with a statement as to the availability for this purpose of funds now in an allotted status.

To enforce a policy, and not to kill, is the objective. The policy of a nation, though maintained and enforced by her soldiers and sailors, is not fashioned by them, but by the civilian population.—*J. F. C. Fuller.*



LIEUTENANT COLONEL ABRAHAM EUSTIS
Commandant Artillery School

March 31, 1824—January 31, 1825
August 1, 1825—November 12, 1828
October 13, 1831—Close of School in 1834

COAST ARTILLERY SCHOOL LIBRARY

BOOKS CATALOGUED

Unless noted thus " * " these books may be obtained by any Regular Coast Artillery Officer; Warrant Officer, A. M. P. S.; or Noncommissioned Officer (Grades 1-3), C. A. C., upon request to the Librarian, C. A. S. Library.

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Harbord, J. G. *Leaves from a War Diary.* 1925. 407 pp.
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BOOK REVIEWS

In the Days of My Father, General Grant. By Jesse R. Grant. Harper and Brothers. 1925. 5¾″x 8¾″. 329 pp. $3.50.

The writer is the youngest son of General U. S. Grant. In collaboration with Henry Francis Granger, he has written his recollections of his father. Tucked away in the middle of the book is a remark which may be taken as the purpose of the work. It reads:

> The world knows of father's victories and defeats, his achievements, his steadfast loyalty, his uncomplaining courage, and it has come to an understanding of his integrity. This would have more than satisfied father, but it does not suffice me. I would have the world know, too, the man I knew.

We find a thumb-nail sketch of the "man I knew" in the following quotation:

> As I see it, father's were not uncommon attributes, there were no flashes of great inspiration; but in him certain fundamental essentials were deeper engrained than in another. Patriotism and loyalty are not uncommon. But in my memory of him, and in his record, father's uncompromising patriotism, his absolute, self-sacrificing loyalty, stand out as the dominant characteristics. He never could have risen to the position he achieved if he had been less loyal. Right or wrong, his country came first, and he supported it with all he had, regardless of his personal opinions or of the consequences to himself. Added to this absolute loyalty, indissolubly incorporated in it, was the will to serve. This was the foundation. To this were added energy, the common sense that recognized the immediate need, constructive vision, and the courage to act. Unhandicapped by selfish ambitions, never wasting or delaying effort in vain regrets, he served with patriotic singleness of purpose.

To this might be added the fact that Grant was not burdened by tradition. When General Sherman, for whom he had great admiration and respect, learned of Grant's plan to cut loose from his base before Vicksburg he opposed the plan saying: "It was an axiom in war that when any great body of troops moved against an enemy they should do so from a base of supplies which they would guard as they would the apple of the eye," etc.; but Grant had no qualms.

The book is an easy-moving narrative of reminiscences, and includes the recollections of the writer on a visit to his father's headquarters at Vicksburg, a similar visit to the Army of the Potomac, the eight years at the White House, and finally the eighteen months' trip around the world with General Grant.

The historical value of the book is slight. It is not always accurate in fact and probably not in opinions attributed to General Grant.—W. W. I.

La guerre n'est pas une industrie. By Colonel Allehaut. Berger-Levrault, Paris. 1925. 5½″x 9″. 156 pp. 6 *fr.* 50.

In 1923 there appeared a publication from the pen of the German Major General von Taysen entitled *Material oder Moral.* The author described his work under a subtitle as "a contribution toward the establishment of a judgment on the combat principles prevailing in the French Army."

General von Taysen appears to have been particularly well informed regarding French military policy, the recruitment laws, combat principles as laid down in the regulations, and methods of training, hence his work appears to have stirred up no small amount of discussion between the opposing parties in the so-called "Materiel versus Effectives" controversy.

The present volume is entirely polemic in character and deals separately with Von Taysen's observations on French combat regulations. The author takes up the argument under separate headings of general combat principles, artillery, cavalry and tanks, aviation, and infantry, in the order named. The general trend of the author's argument is in defense of the regulations, admitting however their susceptibility to further perfection. In some points he takes Von Taysen's viewpoint, in contradiction to combat principles as laid down in regulations.

The whole theme develops about the materiel-manpower question and leaves the reader to answer for himself the burning question—a strong infantry strongly supported by materiel or a hypertrophic materiel poorly protected by a bloodless infantry.—A. M. J.

The Saddle Horse. By W. G. Langworthy Taylor. Henry Holt and Company. 1925. 6″x 8¾″. 270 pp. Ill. $3.50.

The author has in this volume placed in writing his personal experiences, covering a period of several years, as an amateur horseman. In his own words he says, "It has seemed to me that there must be many other persons placed similarly with myself in the matter of horsemanship and that they might welcome a summary of my experiences which are, to a degree, typical and so possibly helpful."

The subject matter has been divided into three parts; namely, Care of the Saddle Horse, Training, and Riding. Each part is covered by a long chapter which is subdivided into several sections. Each section takes up a particular phase of the subject and treats it in a very clear and interesting manner.

Under "Care of the Saddle Horse" the following are some of the subjects covered: the stable, feeding, health, grooming, exercise, ailments, lameness, the underpinning, care of lameness, stumbling, and the groom. The following are the main subjects covered under "Training": conformation, psychology and manners, preliminary training, the Weymouth double bit, vicious defenses, the gaits, gathering and the light hand, the side step, the gallop and change of lead, the Spanish walk and trot, the pirouette and waltz. Under "Riding" the author takes up the subjects of bridling and saddling, mounting, the pose, the reins, stirrups and spurs, the walk, the trot, gait changes, the gallop, riding in general, and why ride.

The whole book is written in a very personal and intimate manner, not as a text preaching doctrine, but rather after the manner of relating experiences and stating of opinions, and for this reason it is anything but dry reading. The work is not well adapted to military purposes, nor was it intended to be. It is however valuable reading matter for officers interested in horses, especially those who own their mounts and who want to know the experiences and opinions of one who knows horses and loves them.—I. B. H.

The Cadence System of Close Order Drill. By Major Bernard Lentz. George Banta Publishing Co. 1925. 5″x 7″. 145 pp. Ill. $0.75.

This well-known book, which made its first appearance in 1918, has been again revised and brought up to date. The new edition conforms in all details to the latest training regulations and their amendments. The book should be in the hands of every commander of troops and every instructor in close order drill.

Notes on the Land Forces of the British Dominions, Colonies, Protectorates and Mandated Territories (exclusive of India). His Majesty's Stationery Office, London. 1925. 6″x 9″. 132 pp. 1s.

A handy reference volume showing the constitution, organization, command and administration, and training of the military and police forces maintained by the many outlying possessions of Great Britain. Chapters are devoted to each of the Dominions—Australia, Canada, New Foundland, New Zealand, and Union of South Africa. Through the rest of the book the Colonies, Protectorates and Mandated Territories are grouped geographically, although each is treated separately in its group. The book is issued by command of the Army Council and, together with similar government publications, may be obtained in the United States, from the British Library of Information, 8th Floor, 44 Whitehall Street, New York City.

E. I. du Pont de Nemours & Company—1802-1902. B. G. Dupont. Houghton-Mifflin Co. 1920. 5½″x 8″. 196 pp. Ill.

On January 1, 1800, Pierre Samuel du Pont de Nemours arrived at Newport, Rhode Island, accompanied by his family, which included two sons, Victor and Eleuthère Irénée. The younger son had studied chemistry in France and had worked for a time in the laboratory of Lavoissier, who was engaged in the manufacture of gunpowder for the French government. It was but natural, then, that, in seeking employment in the new country, his attention should turn to the manufacture of gunpowder. He had considerable difficulty in securing sufficient capital and in acquiring a suitable site, but in April, 1802, the Broom farm, near Wilmington, Delaware, was purchased. In July Du Pont took up his residence on the farm and began to build his plant. By the spring of 1804, there was powder ready for sale, and the E. I. du Pont de Nemours & Company had been established.

This is the company whose history the author traces interestingly through the first century of its existence. Necessarily, the book gives many interesting sidelights on the development of the powder industry, and on the change from black powder to the explosives and propellants in use today. The book closes with the reorganization made in 1902.

Official Automobile Blue Book, 1926. Vol. II. Middle Atlantic and Southeastern States. Automobile Blue Books, Inc. 1926. 5½″x 9¼″. 770 pp. Maps. $3.00.

This is the Silver Anniversary edition—the first edition having been published in 1901—improved by new type, a new folded index map, and an increased number of pages—some fifty more than the 1925 edition.

This book gives all motor routes in the states south of New York and east of Ohio, Indiana, Missouri, Arkansas, and Louisiana, down to the tip of Florida; and includes state motor laws, ferry and steamship schedules and charges, route charts, distance tables, and chatty "Points of Interest." Insurance for one thousand dollars against death or serious injury from an automobile accident is given free to the purchaser.

It is very evident that all parts of the book have been carefully revised and that all late information has been incorporated. This applies not only to the routes, but also to the index map, inserted and city maps, and the guides to Washington, Philadelphia, and New York. The sections on Florida, with many pages advertising certain hotels, counties, lakes, and resorts, are tempting enough to lead one to brave the February snows and freezes and head the flivver for De Sota's land.

The style of type face used in this new issue is worthy of special mention. Place names are set in an extended Roman and the directions following are in a small ex-

tended black face, which makes the book very easy to read in poor light or in a moving car. A bluish paper, very thin but opaque, has been used, so that the complete book of 770 pages, with flexible fabrikoid covers, is slightly over one inch in thickness.

All in all, it appears to be the one best bet for every auto owner, almost as necessary as gas, air, and water for any trip into a strange land.—W. R. S.

Paris on Parade. By Robert Forrest Wilson. Bobbs-Merrill Co. 1925. 7″x 9¼″. 356 pp. Ill. $5.00.

Of the many travel books that are appearing from the press these days, only a small number will be chosen to accompany the traveler when he goes abroad. Mr. Wilson's book is one of the few. He has long lived in Paris, he knows the city, and, in addition, he can write. The result is a most interesting and very readable book on the lesser known but, often, better appreciated parts of Paris. Passing without note the thousand and one things which are described in every guide book and which form the subject matter for most writers on the city of Paris, Mr. Wilson leads us into the by-ways, straight to the sources which he has uncovered, and displays to us that which he has found.

Men will, perhaps, pass rapidly over the first few pages — pages devoted to matters primarily of interest to women—but he will not omit a word thereafter. The book opens with an introduction to Paris — its atmosphere, its smoked gray buildings, its taxis and tangled traffic, its noises, its sub-ways, its markets, its daily routine, all the multitude of things which make it Paris. Then comes the dressmaking establishments, from show rooms through the sales and sewing departments to the designers themselves. A chapter on perfumery, cosmetics, jewelry, and all the other things so dear to the feminine heart, brings us to the apéritif, which we take with Mr. Wilson. Following the apéritif naturally comes dinner, and we examine the restaurants, big and little, known and unknown, all over the city, and we dine at each in turn. Having dined, we examine the Latin quarter and its cafés, Montparnasse, Montmartre, the bookshops and the bookshop crowd, the foreign colonies, business as conducted in the city, the Apaches, and the many other details which do not come to the attention of the ordinary traveler. Even the tourist receives notice in a chapter devoted principally to an exposition of the reasons why tourists see so little of the real city. Having seen the tourist in Paris and having seen Paris through Mr. Wilson's eyes, we agree with the remark with which he closes his book: "Better two free days in Paris than a cycle of Europe, personally conducted."

Ford's views on war and peace have changed radically since the beginning of the World War. * * * He now believes that we shall be most likely to have peace if we have the strongest navy in the world.
—Allen L. Benson.

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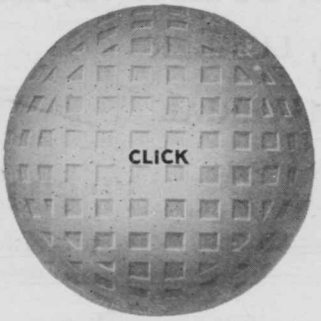

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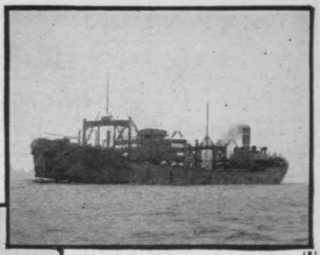

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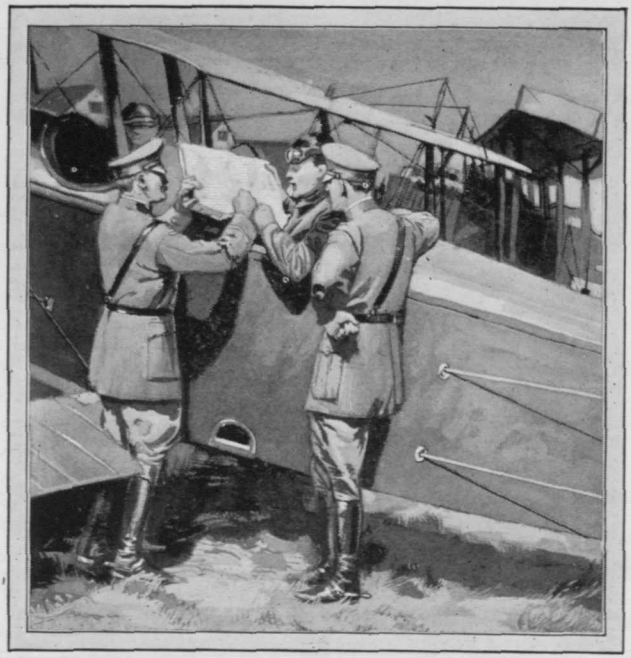

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